FEBRUARY
1961

PRICE 75 CENTS

ELECTRICAL CONSTRUCTION AND MAINTENANCE

WITH ELECTRICAL CONTRACTING

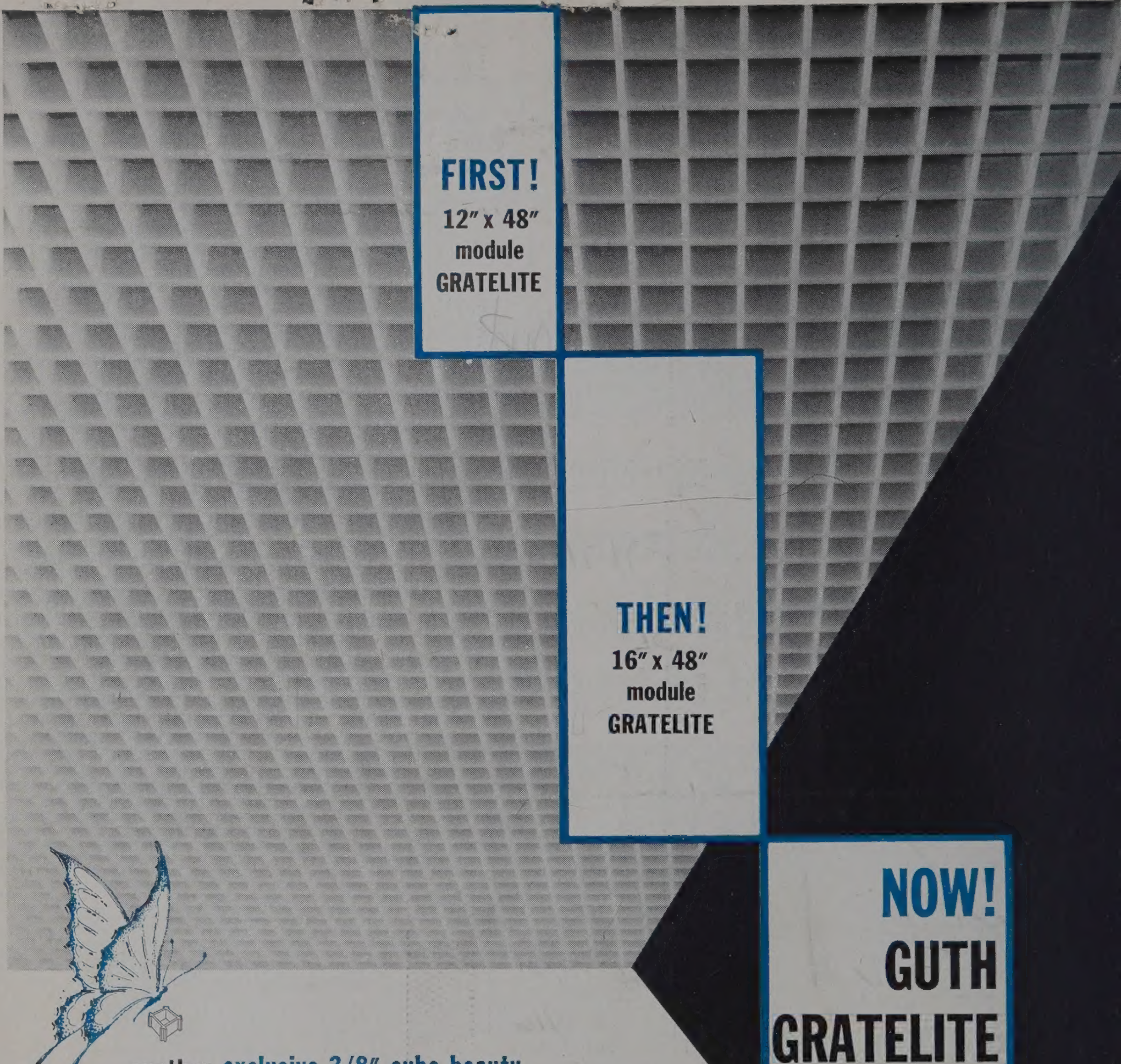
Selling-up residential wiring—a successful contractor program for selling custom wiring systems to buyers of tract homes. page 63

Lighting fixtures in new office building double as air diffusers for cooling and heating. page 68

Industrial electrical modernization project uses cable support trays for flexible feeder distribution. page 74

A McGRAW-HILL PUBLICATION | 60TH YEAR

Libraries
Property



FIRST!
12″ x 48″
module
GRATELITE

THEN!
16″ x 48″
module
GRATELITE

NOW!
GUTH
GRATELITE
LOUVER DIFFUSER*
IN NEW
2′ x 4′
MODULES

another exclusive 3/8″ cube beauty

A big event for Guth lighting! A new addition to the "GrateLite Family". . . the greatest and biggest-selling lighting tool ever developed. Only ⅜″ cubes can give you . . .

BETTER DIFFUSION—Light directed at the closely spaced vanes—on ⅜″ center—is reflected and transmitted through the 55% T.F. translucent plastic . . . less direct light through ⅜″ openings—better diffused light.

LOWER BRIGHTNESSES—⅜″ cubes with 55% T.F. provides greater lighting comfort . . . 100 F.C. GrateLite ceiling has brightness of only 0.41 CP/Sq. In. . . . VCI rating from 93-97% at angles above 45°

GREATER HIDING POWER—⅜″ cube GrateLite "hide" fixtures, lamps, heating and air conditioning ducts, etc., in ceiling plenum. Tests proved GrateLite ⅜″ cubes provide up to 50% better hiding power.

BLENDING POWER—From any angle . . . the vanes blend into a luminious mass of beauty.

EASIER MAINTENANCE—Bugs and dust drop right through and air circulation helps keep them clean . . . keeps efficiency high.

FOR GUTH FIXTURES OR OVERALL ELECTRIC CEILINGS

THE EDWIN F. GUTH COMPANY, 2615 Washington Blvd., Box 7079, St. Louis 77, Mo.

*® U. S. PAT. NO. 2,745,001
CAN. PAT. NO. 538,245
I. B. E.W. Union made and wired

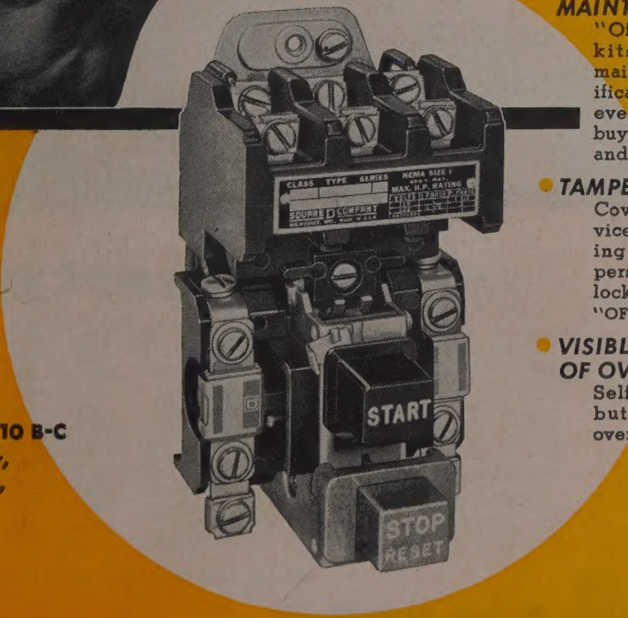
Guth
LIGHTING
since 1902

This NEW Manual Starter has EVERYTHING!

NEMA Sizes 0 and 1

Two, three and four-pole construction

- ***SMALLER!*** Takes less space, whether it's built into machine or mounted externally
- ***SMART STYLING!*** Matches the streamlined appearance of today's modern machines
- ***QWIK-MAKE, QWIK-BREAK!*** Positive snap-action opening and closing of contacts. Longer contact life
- ***TRIP-FREE OVERLOAD PROTECTION!*** Impossible for operator to hold motor circuit closed against overload
- ***POSITIVE PROTECTION!*** Starter will not operate *without* overload units installed
- ***LONGER LIFE!*** *Toggle Action* operating mechanism. Heavy-duty construction throughout
- ***EASIER INSTALLATION!*** Wire it without removing starter from enclosure. All terminals have pressure wire connectors
- ***EASIER MAINTENANCE!*** "Off-the-Shelf" parts kits make normal maintenance and modifications easier than ever. They're easy to identify, easy to buy, and faster to install
- ***TAMPER-PROOF!*** Cover padlocking device prevents tampering by unauthorized personnel. Safety latch locks "start" button in "OFF" position
- ***VISIBLE INDICATION OF OVERLOAD!*** Self-centering pushbuttons show when overload has occurred



CHOICE OF ENCLOSURES:

- Water and Dust-Tight
- Hazardous Locations
- Flush Mounting

***Write* for BULLETIN 2510 B-C**

Address Square D Company,
4041 North Richards Street,
Milwaukee 12,
Wisconsin

SQUARE D COMPANY

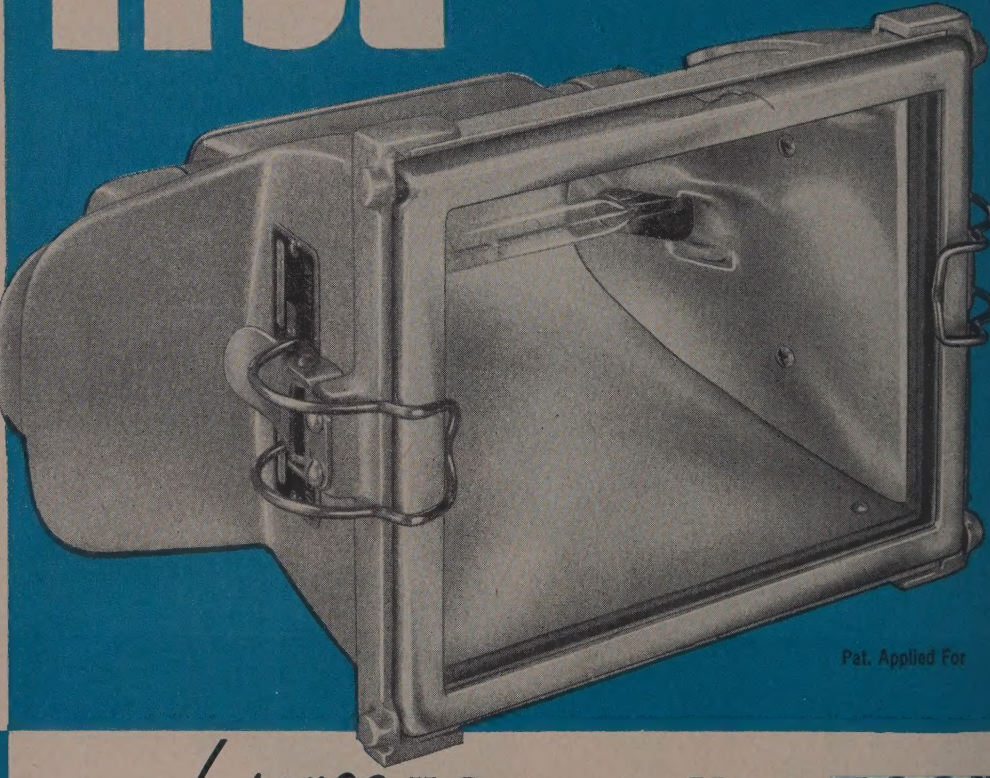
wherever electricity is distributed and controlled

The latest lighting advancement from

APPLETON®

first

lighting unit to give you top operating performance from the amazing Quartzline lamp!



Intenso® "Quartzlite 500"

Only the Appleton *Intenso "Quartzlite 500" is precision engineered to meet the lamp manufacturer's efficiency and operating standards for the new 500-watt, filament type, iodine cycle lamp.*

Its new, compact design was specially developed for this powerful lamp to give you 19% greater, *constant* light out put of 21 lumens per watt . . . and twice the average life of a conventional 500-watt lamp.

That's not all! Now, attractive lighting installations can be made compactly, easily, economically. The special weatherproof unit design also puts light where you want it. Its extremely sharp cutoff—in a rectangular beam spread—eliminates the usual need for beam overlap, yet provides adequate, uniform light for innumerable applications indoors and out.

For increased lighting efficiency in Industry • Commerce • Recreation • Transportation, buy or specify the versatile *Intenso* "Quartzlite 500" . . . ideal for signboards, displays, outdoor sports, building security, mobile equipment, storage areas and many other uses.

Contact your Appleton distributor or write today for complete details!

Sold through franchised distributors only

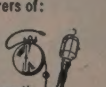
APPLETON®

electric company

Also manufacturers of:

Explosion-Proof Lighting Fixtures

"ST" Series Connectors


Automatic Reelites

Outlet Boxes, Covers, Switch Boxes

1701 Wellington Avenue, Chicago 13, Illinois

ELECTRICAL CONSTRUCTION AND MAINTENANCE

with which is consolidated Electrical Contracting, The Electragist and Electrical Record . . . Established 1901

Published for electrical contractors, electrical departments in industry, engineers, consultants, inspectors and motor shops. Covering engineering, installation, repair, maintenance and management in the field of electrical construction and maintenance.

60TH YEAR • FEBRUARY 1961

Sidelights 7

Washington Report 9

Uninterrupted Power Supply, *An Editorial* 61

Selling-Up Residential Wiring 63

By ALBERT HANDSHUH—Here's how enterprising electrical contractors can successfully attack the big market for house wiring—with a planned program, based on sound principles of promotion and merchandising and aimed at giving each homeowner a "custom-tailored" wiring system.

Lighting, Heating, Cooling from Luminaires 68

Combination light and air diffuser fixtures provide comfort conditioning throughout the Harris Trust and Savings Bank's new 23-story office building. Modular design permits flexibility of partition arrangements.

Office Wiring Problems 70

An account of how the consulting engineers solved some difficult problems concerning risers, lighting and air conditioning in converting an attic storage space to an office area.

Industrial Feeder Circuits Use THW Conductors on Tray 74

By J. F. McPARTLAND—Economy and flexibility of power distribution are provided by circuits of THW—insulated conductors supported in ladder-type cable tray at the modernized industrial plant of Savage Arms Corp.

Estimating Forum IX 78

By RAY ASHLEY—Analyze tool savings—don't guess.

CBs and Contactors for High-Voltage Circuits 79

By J. P. McCAUSLIN—Effective design of modern high-voltage electrical systems often involves selection of circuit breakers and/or contactors for feeder disconnect and protection and for motor control.

Material Handling Ingenuity Pays Off 84

By F. W. MICHAL—Pre-engineered, mechanized flow pattern enabled 5-man crew to hang nine 650-lb florescent fixtures per day, 35 ft above floor level at Chicago's new exhibition hall.

MORE

"Count on us for sure . . . from start to finish."

By "us" your Graybar salesman means the team of Graybar experts that serves you, the electrical contractor . . . whether your business be large or small.

This service team knows how to size up a job and evaluate equipment to match the need. They can unravel knotty installation problems.

Often they can make valuable suggestions on tools, for Graybar carries the most complete line of tools available from any electrical distributor.

From start to finish you can count on the Graybar service team . . . Field Salesman, Inside Salesman, Counterman, Specialist. Others too, at Graybar can help *speed your work, reduce your costs, build your business.*

Know them? They're ready to work with you—*today!*

919

Graybar Service includes: Objective recommendations • On-the-job technical help • Most complete lines • Planned stocks to meet your needs • Expert counter service • Speedy handling of will-calls.

GraybaR

ELECTRIC COMPANY, INC.

420 LEXINGTON AVENUE, NEW YORK 17, N. Y. • OFFICES IN OVER 130 PRINCIPAL CITIES

W. T. STUART, *Editor*
Alice McMullen, *Managing Editor*

Associate Editors
Berlon C. Cooper, *New York*
August Eckel, *Chicago*
J. F. McPartland, *New York*
W. J. Novak, *New York*
Hugh P. Scott, *San Francisco*
John H. Watt, *New York*

Art Editor
L. E. Devendorf

Assistant Editor
R. J. Lawrie

Editorial Assistant
Mary A. Corich

Consulting Editors
Ray Ashley, *Chicago*
B. A. McDonald, *Rochester*
B. Z. Segall, *New Orleans*
R. E. Ward, *Nashville*

Douglas Greenwald, *Man., Economic Services*
George B. Bryant, Jr., *Chief Correspondent, Washington Bureau*
John Wilhelm, *Manager, News Bureaus*

W. W. GAREY, *Publisher*
A. L. De Weerdt, *Circulation Manager*
W. C. Carmichael, *Business Manager*
Ann P. Barrett, *Production Manager*

R. A. Hubley, *Advertising Sales Manager*

A. B. Conklin, *New York*
E. P. Gardner, *New York*
A. E. French, Jr., *Philadelphia*
F. J. Seiler, *Cleveland*
J. E. Lange, *Detroit*
Charles F. Minor, Jr., *Chicago*
R. R. Ream, *Chicago*
T. H. Carmody, R. C. Alcorn, *San Francisco*
F. E. Le Beau, *Dallas*
F. E. Holland, *Houston*
Noel Humphrey, *Los Angeles*
R. H. Powell, *Atlanta*

Member of
AUDIT BUREAU OF CIRCULATIONS and
ASSOCIATED BUSINESS PUBLICATIONS

ELECTRICAL CONSTRUCTION AND MAINTENANCE

FEBRUARY • 1961 *continued*

Heat Pumps Serve a 300-Home Community 87

Entire Gold Medallion suburb near Sacramento, Calif., uses heat pumps exclusively for year-'round climate conditioning of 300 all-electric residences.

Electric Heating Forum No. 8 90

The first of a series exploring the good and bad effects of moisture in the electrically heated home.

Practical Methods 97

Pulling machines for transmission lines; work platform reduces maintenance costs; plastic conduit speeds underground installation.

Motor Shops 107

Portable dip tank rack for coil impregnation; pegboard workbench ups shop efficiency; banding armatures with glass tape.

Reader Service 113

Product news announcements; catalogs and bulletins.

Reader's Quiz 141

Questions and answers on grounding methods; exciter capacity; air conditioner ratings.

Questions on the Code 152

Answers to code questions on dwelling receptacles; rigid metal conduit water pipe; garden lighting; feeder calculations; wiring for a submersible pump.

In the News 163

Dates Ahead 178

Vol. 60, No. 2 ELECTRICAL CONSTRUCTION and MAINTENANCE FEBRUARY 1961

Published monthly with an additional issue in September by McGraw-Hill Publishing Company, Inc. James H. McGraw (1860-1948), Founder. Executive, Editorial, Circulation and Advertising Offices: **McGraw-Hill Building, 330 W. 42nd St., New York 36, N.Y.** Printed in Albany, N.Y. **Officers of the Publications Division:** Nelson L. Bond, President; Shelton Fisher, Wallace F. Traendly, Senior Vice Presidents; John R. Callaham, Vice President and Editorial Director; Joseph H. Allen, Vice President and Director of Advertising Sales; A. R. Venezian, Vice President and Circulation Coordinator. **Officers of the Corporation:** Donald C. McGraw, President; Joseph A. Gerardi, Hugh J. Kelly, Harry L. Waddell, Executive Vice Presidents; L. Keith Goodrich, Vice President and Treasurer; John J. Cooke, Secretary.

This publication is available only by paid subscriptions which are solicited from persons engaged in electrical construction, maintenance or consulting services. The publisher reserves the right to refuse subscription service to others. **Position and company connection must be indicated on subscription orders.**

United States subscription rate for individuals in the field of the publication $3.00 per year. This issue 75 cents. Electrical Products Guide $2.50. Canada $5.00 a year. All other countries, $15.00 a year, payable in advance. Second class postage paid at Albany, N.Y. Printed in U.S.A. Title registered in U. S. Patent Office. © Copyrighted 1961 by McGraw-Hill Publishing Co., Inc.—All Rights Reserved.

UNCONDITIONAL GUARANTEE: Subscription service may be discontinued at any time on written request by the subscriber. The publisher will refund the part of the subscription price applying to the remaining unfilled portion of the subscription.

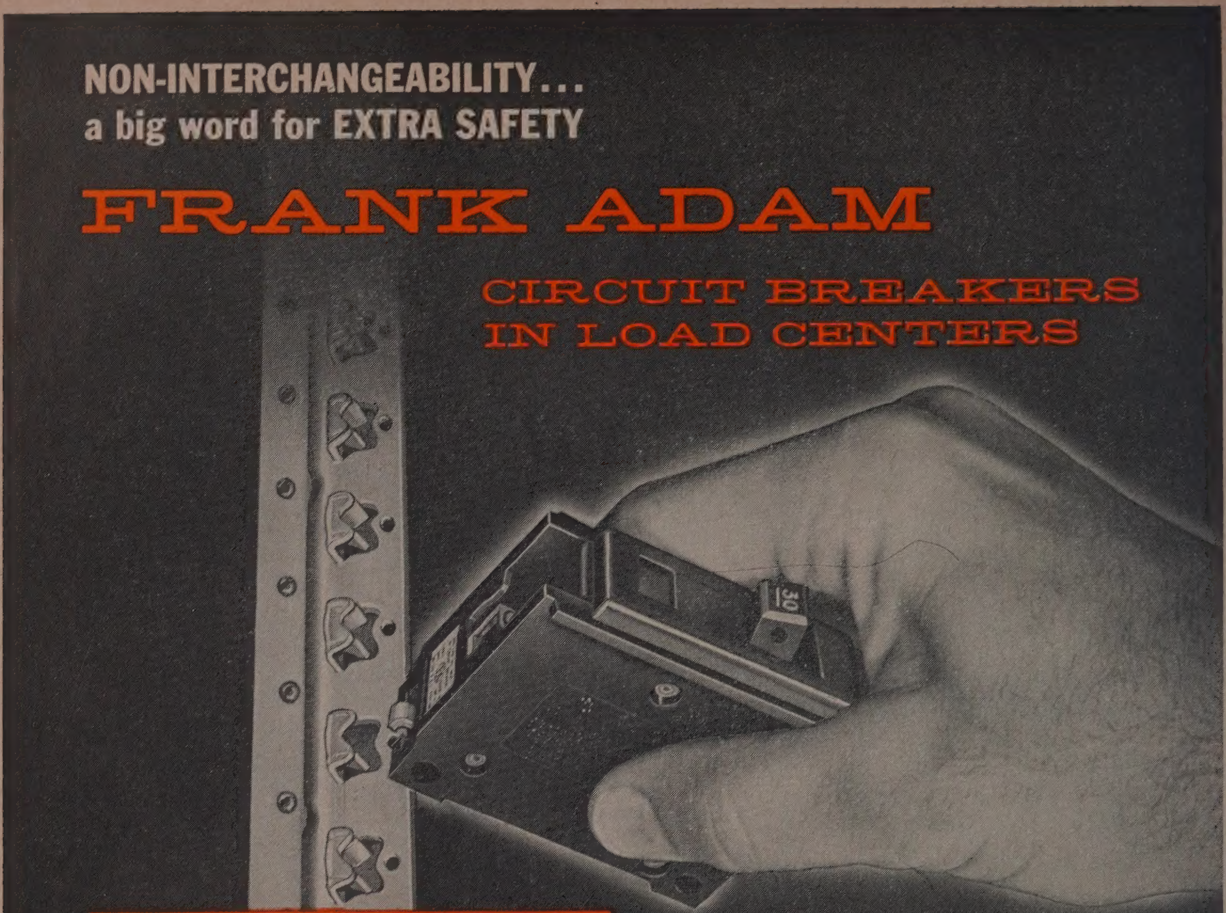
SUBSCRIPTION: Send subscription correspondence and change of address to Subscription Manager, Electrical Construction and Maintenance, 330 West 42nd Street, New York 36, N. Y. Subscribers should notify Subscription Manager promptly of any change of address, giving old as well as new address, and including postal zone number, if any. If possible, enclose an address label from a recent issue of the magazine. Please allow one month for change to become effective.

Postmaster . . . Please send form 3579 to Electrical Construction and Maintenance, 330 West 42nd St., New York 36, N. Y.

NON-INTERCHANGEABILITY . . .
a big word for EXTRA SAFETY

FRANK ADAM

CIRCUIT BREAKERS IN LOAD CENTERS



IT'S EASY AND QUICK TO PREPARE Ⓕ LOAD CENTERS FOR NON-INTERCHANGEABILITY

Removal of interference tabs in mounting back takes but a moment with simple tool furnished by Ⓕ Distributor.

FRANK ADAM NEW LOAD CENTERS have sequence bussing to permit any combination of 2-pole circuits—have dual-rated lugs for copper or aluminum wire (in 100-amp. centers and higher—plus many more features that make them a "best Buy."

• • • • • • • •

FRANK ADAM Quicklag CIRCUIT BREAKERS are furnished in 1, 2 and 3-pole in 2 types:

QP—Plug-In QS—Bolt-On

Ratings: 15, 20, 30, 40, 50 and 70 amps.

To prevent installation of higher-rated circuit breakers into branches with lower capacities—this is the purpose of Paragraph 240-25G on non-interchangeability in the 1959 National Electric Code. Frank Adam QP breakers comply with these NEC requirements.

1, 2 and 3-pole breakers rated above 20-amps. are equipped with rejection slugs that require removal of interference tabs in load center mounting backs before they can be installed. This preparation takes but a moment. These interference tabs prohibit the substitution of 30 to 70 ampere breakers on the mounting back in place of smaller capacity breakers. Proper programing instructions are furnished to the installing contractor.

This *extra safety* feature is only one of the many reasons for the superiority of Frank Adam Quicklag Circuit Breakers. Get the complete story—*write for bulletin.*

See our catalog in SWEET'S

FRANK ADAM ELECTRIC COMPANY
SINCE 1891
P. O. BOX 357, MAIN P. O. • ST. LOUIS 66, MO.

busduct • panelboards • switchboards • service equipment
safety switches • load centers • Quikheter

Sidelights

SELLING-UP RESIDENTIAL WIRING

How can the individual electrical contractor on his own initiative successfully open up the market for bigger and better-value electrical systems on large tract projects with standardized, basic wiring plans? The key is a personalized, planned program based on sound, practical promotion and merchandising aimed to give each home buyer the opportunity to have a custom-tailored wiring system fitted to his own needs and prospects. In actual current practice one such program is producing an average increase of 35% in sales volume. Albert Handshuh, president of Reliable Electrical Contractors, Inc. of East Orange, N. J., tells how in "Selling-Up Residential Wiring" beginning on page 63.

INDUSTRIAL FEEDERS ON TRAYS

Economy and flexibility of power distribution on an industrial electrical modernization project are provided by feeder circuits of THW insulated conductors supported in ladder-type cable trays at the Savage Arms Corporation plant in Westfield, Mass. The system was designed by Chester Blumenauer, consulting engineer, and installed by Collins Electric Co. of Springfield, Mass. The method, though controversial with respect to existing interpretations of the code, was approved by local inspection authorities. The project is described in "THW Conductors on Tray" beginning on page 74.

MATERIAL HANDLING INGENUITY

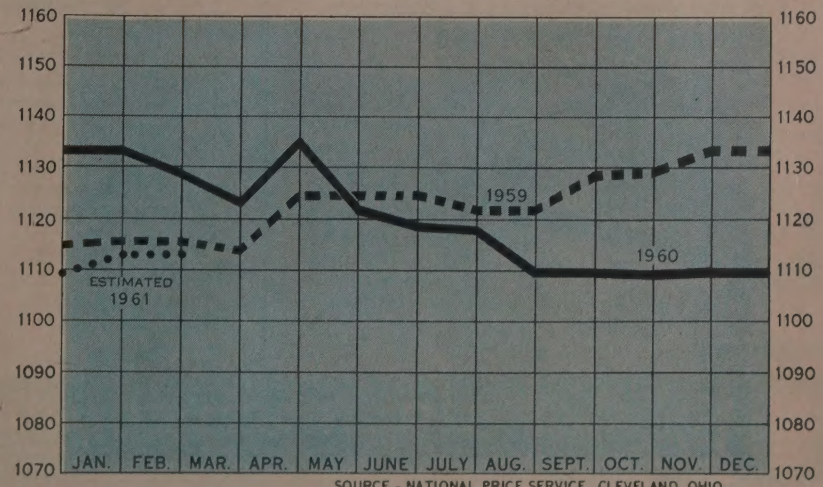
Pre-engineered, mechanized job plan and special equipment enabled a 5-man crew to hang nine 650-lb fluorescent fixtures per day 35 ft above floor level. The installation of custom built lighting equipment was made at McCormick Place, Chicago's new exhibition hall. Details of the precisely organized flow patterns are described on page 84, by Frank W. Michal, of Fischbach, Moore and Morrisey, Inc. of Chicago, electrical contractors for the giant project.

DESIGN TECHNIQUES SOLVE FEEDER PROBLEMS

Building a spacious new office area in what was formerly attic storage of the 15-story Wanamaker Building in New York posed some difficult problems concerning the electrical supply for power, lighting and a new 600-ton air conditioning plant. The feeder problem was solved by stepping up the 208-volt network supply to 600 volts for the risers from the basement entrance to the 15th floor load center. The novel installation is described in "Clever Design Techniques Solve Office Wiring Problems" beginning on page 70.

ELECTRICAL MATERIALS COST INDEX

BASE LINE (1000) REPRESENTS COSTS OF TYPICAL ASSORTMENT OF MATERIALS FOR A SELECTED JOB AS OF NOVEMBER 1, 1951. INDEX POINTS REPRESENT THE VARIATION OF THESE SAME MATERIAL COSTS AS OF THE FIRST OF EACH MONTH.

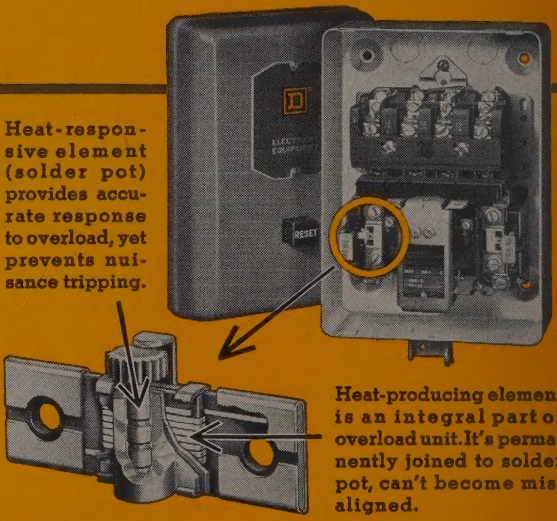


SOURCE - NATIONAL PRICE SERVICE, CLEVELAND, OHIO

ONLY SQUARE D STARTERS WITH ONE-PIECE OVERLOAD RELAYS GIVE ABSOLUTE PROTECTION!

• Only Square D makes thermal overload relays with 1-piece construction—and only with 1-piece construction can you *know* you've installed the heater correctly. Square D 1-piece overload relays can be installed only one way. They are factory-assembled, individually tested and calibrated, completely tamper-proof. Repeated tripping will not affect accuracy.

You *pay* for overload protection—be sure you *get* it. Insist on Square D 1-piece overload relays for *absolute* protection.

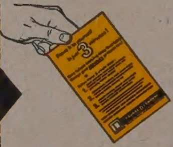


Heat-responsive element (solder pot) provides accurate response to overload, yet prevents nuisance tripping.

Heat-producing element is an integral part of overload unit. It's permanently joined to solder pot, can't become misaligned.

EXCLUSIVE—
1-piece Overload Relay
for *ABSOLUTE* Protection!

Mail coupon today for simple "jig-saw" demonstrator—see why only Square D gives absolute protection



Square D Company
Department SA-221
4041 North Richards Street
Milwaukee 12, Wisconsin

Please send me information on Square D magnetic starters, along with your simple 3-minute "jig-saw" demonstrator

NAME____________________

COMPANY____________________

ADDRESS____________________

CITY__________ZONE____STATE________

SQUARE D COMPANY

wherever electricity is distributed and controlled

Washington Report

FEBRUARY • 1961

A new era in American history began January 20, when John Fitzgerald Kennedy, 43, took the oath of office as President of the United States. Thus passed the powers of the Presidency from Dwight D. Eisenhower, 70, oldest man ever to hold this office, to President Kennedy, youngest ever elected to it.

What the new era will bring forth will depend, in part, on how President Kennedy, his Cabinet, and the Congress, meet and handle the problems passed on to it by the outgoing Administration. The problem of greatest importance is that of dealing with the Communists, and all the other vital problems inherent therein—danger of nuclear war, relations with our allies, needs of people in the underdeveloped nations, and ways and means of sustaining the American economy.

Status of the American economy as President Kennedy took office was, as President Eisenhower outlined in his State of the Union message to Congress early in January, "operating at high levels." Economists and advisers to President Kennedy, however, were less optimistic. In a series of specially prepared reports, task groups called for vigorous Government action to ward off what they viewed as a continually worsening economic situation.

Here are the statistics on some of the economic factors, as reported by the various Government agencies:

- **Unemployment**—Labor Dept. reported 4,540,000 workers out of jobs at mid-December 1960, or 6.8% of the total work force on a seasonally adjusted basis, highest since 1940. New Labor Secretary Arthur Goldberg estimated unemployment at mid-January at 5,500,000. Thus, President Kennedy, on January 21, directed increased distribution of free food to needy families in areas of chronic unemployment. Concurrently, some of the hard-hit states stepped up efforts to combat rising unemployment.

- **Gross National Product**—GNP, or the total of all goods and services produced, is expected to exceed $502 billion in 1960, compared with $482 billion in 1959.

- **Personal Income**—Commerce Dept. reported personal income fell in the final two months of 1960, for first non-strike drop in two years. The seasonally-adjusted annual rate in December was $406.7 billion. October's record rate was $409.7 billion. Total for 1960 was a record $404.2 billion, up 5% from 1959.

- **Industrial Production**—Industrial output declined in December for the fifth straight month, to 103% of the 1957 average, FRB reported. The record was set in January 1960 at 111%.

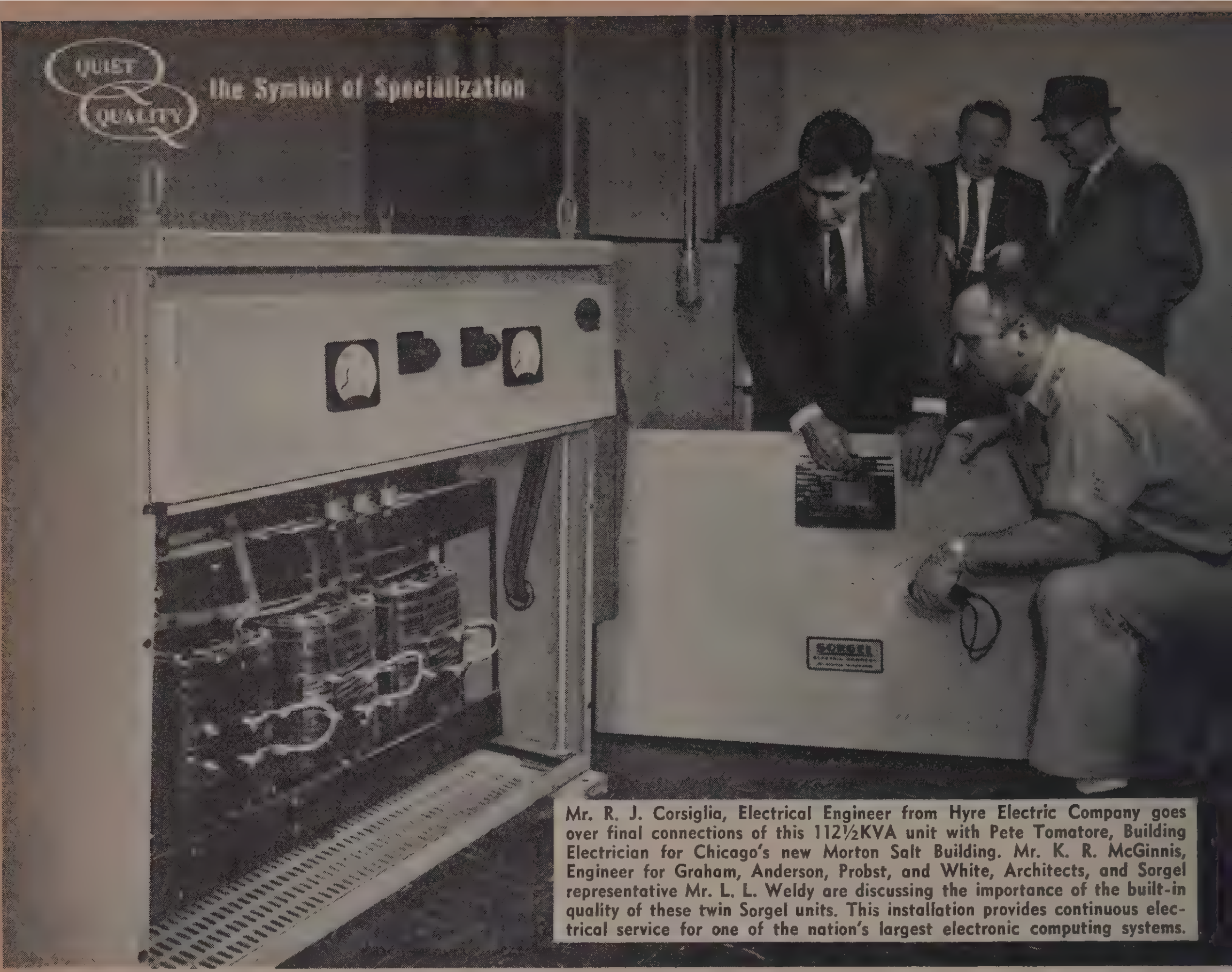
- **Steel Production**—Steel output in 1960 totaled just under 100 million tons, compared with just under 94 million tons in 1959. The record output was 117 million tons produced in 1955.

- **New Construction**—Total new construction for the first eleven months of 1960 was $50,684 million, down 2% from the first eleven months of 1959. Total for 1959 was $56,206 million. Commerce Dept. has forecast a record $57.3 billion total of new construction for 1961.

- **Residential Building**—Dept. of Commerce reports outlays for new dwellings in 1960 at $16.45 billion, and forecasts a rise of $350 million to $16.8 billion this year. The record was set in 1959, at $24,469 million.

Electric utility companies have 40 million kw of new generating capacity on order and scheduled for service. About 85% of this new capacity is expected to be in operation by 1963. Total generating capacity in the continental United States at the end of 1960 was over 175 million kw, up 7% from 1959.

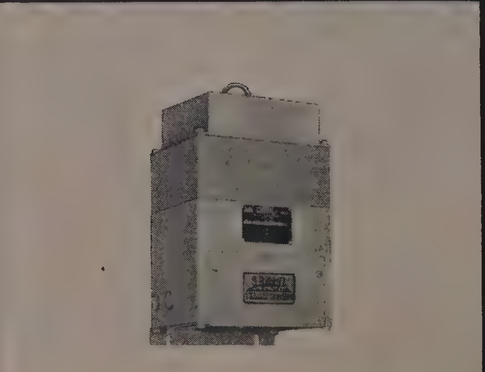
QUIST QUALITY The Symbol of Specialization



Mr. R. J. Corsiglia, Electrical Engineer from Hyre Electric Company goes over final connections of this 112½KVA unit with Pete Tomatore, Building Electrician for Chicago's new Morton Salt Building. Mr. K. R. McGinnis, Engineer for Graham, Anderson, Probst, and White, Architects, and Sorgel representative Mr. L. L. Weldy are discussing the importance of the built-in quality of these twin Sorgel units. This installation provides continuous electrical service for one of the nation's largest electronic computing systems.

SORGEL HAS A DRY-TYPE

1/4 KVA
TO
10,000 KVA,
ALL STANDARD
AND
INTERMEDIATE
VOLTAGES
UP TO
15,000
VOLTS



Unit above is typical of construction for ¼ KVA up to 7½ KVA sizes. Popular sizes up to 75 KVA both single and 3-phase transformers are normally in factory stock.

Stock units, such as 75 KVA shown here, are shipped on day order is received. All sizes up to 75 KVA are constructed to be interchangeable for floor or wall mounting.

HERE'S WHY SORGEL TRANSFORMERS MEAN DOLLARS AND SENSE TO YOU

Sorgel equipment installs easier, provides unusual reliability, and operates economically at high efficiency

More and more Sorgel dry-type transformers are being installed daily in new or modernization construction for schools, shopping centers, hospitals, industrial plants and office buildings of all sizes. Here's why: Contractors prefer Sorgel primarily because of their easy installation and reputation for quality. Enclosures are self-supporting. Entrance can be made on sides, top, bottom or back. Solderless connectors speed up terminal wiring, as does roomy compartment.

Consulting and plant engineers insist on Sorgel quality because of high efficiency, and a fully rated load operating continuously at a safe temperature.

Direct advantages of Sorgel equipment to all buyers include lower copper loss, lower core loss and the lowest sound levels available. Sorgel continuously provides the most liberal designs and a coordinated system of either Class B, F, or H insulation with effective use of quality materials throughout each transformer produced. Take advantage of this unique combination of experience and engineering skills by insisting on Sorgel quiet quality transformers.

SORGEL
SOUND-RATED DRY-TYPE
TRANSFORMERS

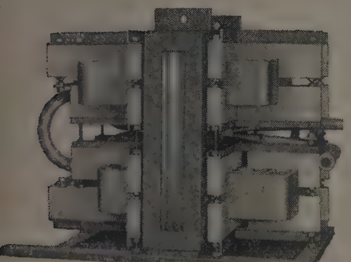
SORGEL ELECTRIC COMPANY

Since 1916 the pioneer in the development, manufacturing and application of sound-rated dry-type transformers

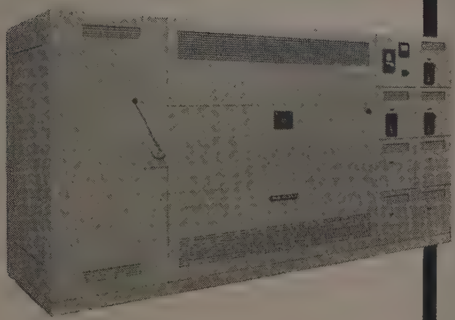
836 WEST NATIONAL AVENUE • MILWAUKEE 4, WISCONSIN

Experienced sales engineers in principal cities

TRANSFORMER FOR YOUR EVERY NEED



This electrical magnetic pump transformer, used with fluid lithium, is an example of Sorgel's engineering abilities to handle tough customer designs.

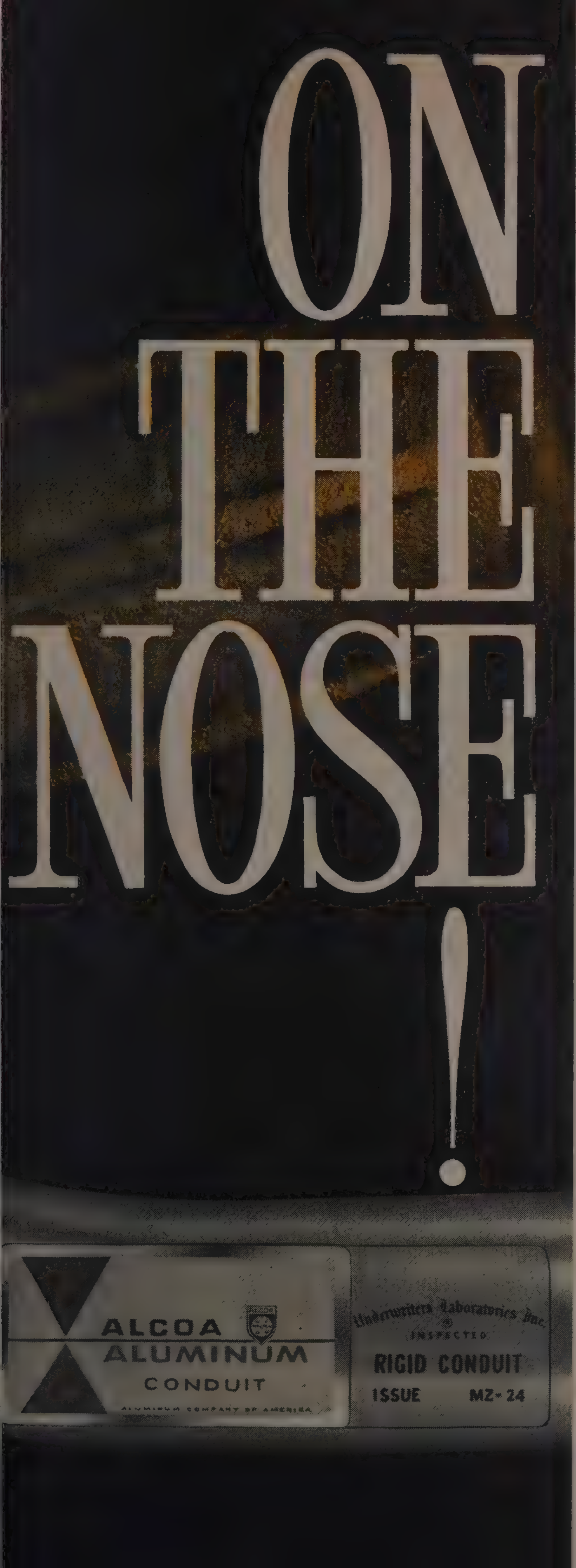


This 2,000 KVA, 3 phase, 13,200 volt, unit is typical of Sorgel load centers. These units are procurable with any type or make of switch gear.

CLIP AND MAIL FOR TECHNICAL BULLETINS.

☐ 611—Transformer Line
☐ 960—Sub-stations
☐ 658—DC Saturable Reactors

Name__________
Title__________
Address__________
City__________
State__________



...just one of the reasons why Alcoa aluminum electrical rigid conduit is so easy to install

No spring-back in aluminum conduit means bends "on the nose" every time.

For small sizes, use a hickey or an EMT bender (one size larger). Regardless of size, mechanical and hydraulic benders make one-shot, uniform bends with a minimum of time and effort.

What else is there to look for in conduit?

Weight Alcoa aluminum conduit weighs only one-third as much as steel conduit. From warehouse to erection site there is only one-third as much weight to lift, load, carry and erect.

Cutting and threading With hacksaw on small sizes and power on large, cutting is quick and easy. Use sharp dies and regular cutting oils, and get clean, well-formed threads every time.

Wirepulling Wire aluminum conduit quickly, easily—using a plastic "rigid" rope fish tape, a flexible round steel tape, or a pressure-operated gun and plastic pulling rope. Alcoa conduit is factory lubricated for easy pulling.

Don't forget, too, that Alcoa aluminum conduit makes a good investment for your *customers*. It's corrosion-resistant, nontoxic, nonmagnetic, nonstaining, neat in appearance, with a seemingly endless service life.

Get all the facts and figures for your next job. Additional information and help are available from your nearby Alcoa-Rome representative. Or write to Dept. 7-21, Rome Cable Division of Alcoa, Rome, New York, for free technical literature.

EASY TO BEND. Alcoa aluminum conduit can be bent quickly, easily. Use EMT benders or hickeys with sizes to 1¼ inch. Standard power benders (below) can be used on all sizes.

ROME CABLE
DIVISION OF **ALCOA**

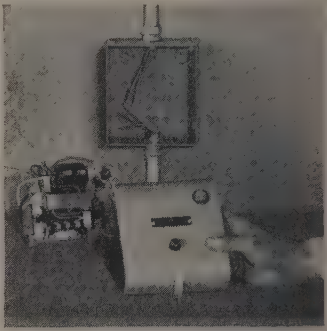
General Electric CR106 Magnetic Starters . . .
HOOK-UP TIME: 3 MINUTES

To mount starter in case, slip key-hole slots over three mounting screws and tighten. Next, insert stripped leads into pressure-type terminals located in front and tighten. All line terminals are at top, all load terminals at bottom.

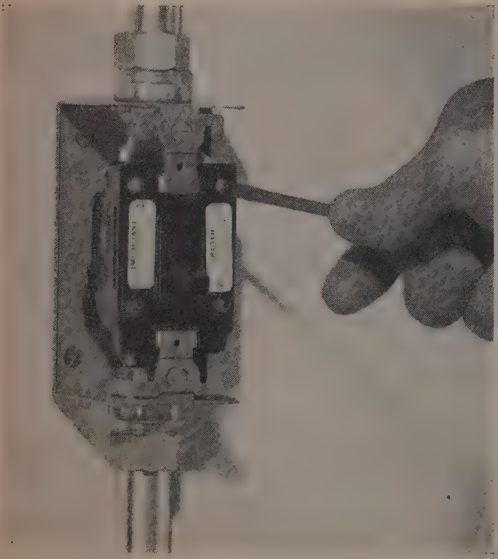
Time elapsed? Only *three minutes.* Multiply this times the number of starters you install every year, and count your dollar savings with General Electric CR106 Starters.

TYPICAL MODIFICATION TIME: ADD INDICATING LIGHT IN 3 MINUTES

General Electric offers industry's widest selection of starter field modification kits to meet special operating conditions. Off-the-shelf kits are available for installation of indicating light, push button and selector switch in starter covers; auxiliary contacts; third overload relay; different-voltage coil; and (on combination forms) fuse clips for different current or voltage.



General Electric CR101 Manual Starters . . .
HOOK-UP TIME: 2 MINUTES



First, insert stripped line leads in pressure-type terminals at top and load leads in bottom terminals and tighten. Next, position starter and tighten two mounting screws.

Insert heater. Exclusive design plugs in from the front and is keyed to prevent incorrect insertion. Compare hook-up time with that required for any other manual starter and see how you save with General Electric CR101 Starters.

TYPICAL MODIFICATION TIME: ADD INDICATING LIGHT IN 1 MINUTE

Kit packaging of G-E CR101 manual starter components gives you unequaled modification versatility. Kits available for single or combination forms include flush plates with or without indicating light, front cover with or without indicating light, and back box.

Your nearby General Electric distributor has a complete line of starters and modification kits in stock. Ask him for Publications GEA-7020 and GEA-6358, or write Section 812-06, General Electric Co., Schenectady 5, N. Y.

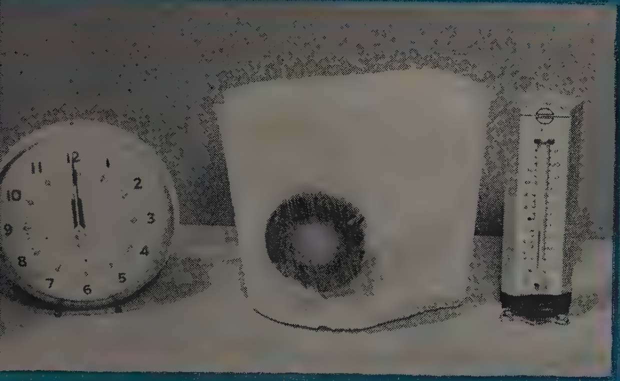
You get **MEASURABLE ADVANTAGES**
WITH GENERAL ELECTRIC CONTROL

Progress Is Our Most Important Product

GENERAL ELECTRIC

HEN IT'S COLD - THE SPLICE WILL HOL
ITH SLIPKNOT CW
NYL ELECTRICAL TAPE!

REMARKABLE VERIFIED TESTS PROVE THAT UL-APPROVED
IPKNOT CW WORKS PERFECTLY UNDER THE
OST SEVERE COLD-WEATHER CONDITIONS!



oll of Slipknot CW is frozen solid in a block ice at 14° F below zero.

Tape is broken out of ice . . . still at 14 below . . .

and in this frigid atmosphere remains com pletely flexible — strips perfectly from roll — even with ice still imbedded in the core.

14° F below zero, this remarkable vinyl tape

- Strips easily from the roll . . .
- Remains completely flexible . . .
- Sticks down instantly — molds perfectly — holds permanently!

it in your home freezer — write for a sample roll on your letterhead today!

35 seconds later perfectly conforming splic is made. Temperature . . . still 14° below!

TAPES BY
SOLD ONLY THRU
ECOGNIZED
STRIBUTORS
RUBBER COMPANY INC

PLYMOUTH RUBBER COMPANY, INC.
QUALITY SINCE 1896 CANTON, MASSACHUSETTS

KOOL KOIL

FLUORESCENT LAMP BALLASTS

BEST SOLVE TODAY'S HEAT PROBLEMS

Because

KOOL KOIL case temperatures are guaranteed not to exceed 90°C operating in a 55°C heat box . . . a heat box with temperatures 15°C over standard CBM and U/L testing procedures.

Because

KOOL KOIL ballasts are guaranteed not to overheat capacitor insulating oil beyond manufacturer's warranty limits.

Because

KOOL KOIL ballasts will give up to 15% more light output, operate 15 to 20 degrees cooler and increase ballast life 3½ to 4 times.

Today's fixture designs of extremely thin lighting units, surface mounted, or recessed in a ceiling cavity require cooler operating fluorescent lamp ballasts. Overheating of ordinary ballasts can break down the components, lower the operating efficiency, and even destroy the ballasts completely.

To meet these conditions ADVANCE engineers developed a new ballast design incorporating the use of new grades of steel, insulations, wires and compounds . . . . KOOL KOIL fluorescent lamp ballasts . . . . ballasts that will maintain temperatures lower than standard test requirements, (case temperatures of less than 90°C) even when operation in channels of 55°C ambient temperature is encountered. KOOL KOIL performance protects components against breakdown, provides 15% more light output and increases ballast life 3½ to 4 times over ordinary ballasts. Write for complete details.

"The Heart of the Lighting Industry"

ADVANCE® TRANSFORMER CO.
2950 NO. WESTERN AVE. CHICAGO 18, ILL. U.S.A.

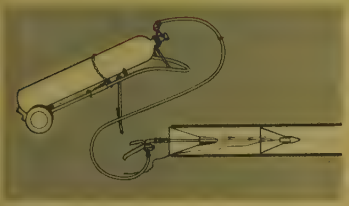
BRAND NEW!

GraybaR's IDEA BOOK #2

- More than 48 products and ideas to make your electrical work go faster and easier!
- Must reading for contractors, utility men, maintenance people, purchasing agents!

NOW!

Install pull lines in underground conduit in seconds with JET LINE!



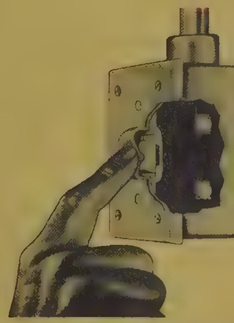
With the new Jet Line Underground Unit, one man can put a line through 1¼" to 4" underground conduit in *seconds*, regardless of bends, mud or water. In distances up to 1500 feet, it eliminates rodding and snaking, saving time, labor and money. Uses CO_2, available everywhere at low cost, as a source for power.

Simply cut the cones to fit the size conduit you're using, attach the line, and the pressure of the gas forces the line cone through the pipe, clearing mud, water, loose obstructions, etc., and laying a strong nylon line as it goes. Then pull your wire through the conduit using the line.

Learn about the complete Jet Line system—send for our free catalog and price list. Simply circle number 1 on the Graybar postcard.

JET LINE PRODUCTS INC.

WEATHERPROOF INSULPRENE® PLATE and A.C. PRESSWITCH COMBINATION



Cut-away shows A.C. "Presswitch" mounted in FS box and protected by new Weatherproof "Insulprene" Plate.

Introducing a combination unit—complete in one box—including weatherproof "Insulprene" plate and A.C. "Presswitch" . . . designed for all general outdoor applications: shipping areas, parking lots, gas stations, breezeways, etc. The weatherproof "Insulprene" plate fits both FS and standard wall boxes. The combination is available with 15 or 20 amp. "Presswitch" either single pole, double pole, 3-way or 4-way. "Insulprene" plate resists oil, hot water, live steam, extreme cold, grease, etc. Simply circle number 2 on the Graybar postcard.

HARVEY HUBBELL, INCORPORATED

Small size... Big Performance! TRIANGLE Triolene-Trioseal Thermoplastic Control Cable

TRIANGLE Triolene-Trioseal Control Cable gives full "big cable" performance, with less than two thirds the size and weight of comparable rubber cable. Outer covering of Trioseal Thermoplastic provides protection against moisture and flame. Double-wall insulation of individual conductors—20 mil polyethylene (Triolene), 10 mil polyvinylchloride (Trioseal)—provides excellent resistance to chemical attack.

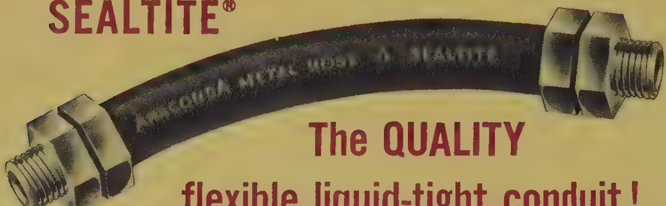
TRIANGLE Triolene-Trioseal is an ideal general purpose control cable . . . for conduit, aerial, duct, direct burial—in wet or dry locations. Rated at 600 volts for either AC or DC circuits and copper temperature of 75° C. For complete technical information, circle number 3 on the Graybar postcard.

TRIANGLE CONDUIT & CABLE CO.

For more information on any

For complete protection...

SEALTITE®



The QUALITY flexible liquid-tight conduit!

When planning wiring protection, specify quality Sealtite and liquid-tight connectors for Sealtite. This gives *complete* protection because leading liquid-tight connectors were designed to Sealtite dimensions . . . make a tight fit . . . and *hold!* Available in ⅜″ to 4″ sizes; in black, gray or white in Type E.F.

Send for your copy of our free bulletin showing illustrations, uses and specifications for all three types of Sealtite conduit. Just circle number 4 on the Graybar postcard.

ANACONDA METAL HOSE DIVISION
ANACONDA AMERICAN BRASS COMPANY

NEW from BERNZ-O-MATIC!

Double-value Carry-all Torch Kit

Here's a complete BERNZ-O-MATIC Torch Kit with metal carrying case and attachments for doing hundreds of maintenance, repair and construction jobs! Comes complete in a metal enameled carrying case, with plenty of storage space to add additional tools, plus solder, flux, etc. Lets you do jobs easier and faster, while saving time and money!

For information on the complete line of Bernz-O-Matic equipment, send in the handy Graybar postcard. Circle number 5.

OTTO BERNZ CO., INC.

For extra hard usage...

PWC YANKEE SAFETY CORDS

Here's the perfect safety cord for industrial, municipal and public utility applications where safety is particularly stressed. The chrome yellow jacket color is easily discernible and can be printed with personalized markings as desired. A special oil-proof compound is used in both the conductor insulation and over-all jacket. Will not support combustion. Non-marking. U.L. label. For a complete listing of available conductors, voltage and temperature ratings, etc., circle number 6 on the Graybar postcard.

THE PLASTIC WIRE & CABLE CORPORATION

REDUCE OUTDOOR LIGHTING COSTS

Four Conduit Pipe Sizes
H42200—2″ H42250—2½″
H42300—3″ H42400—4″

Base with 3-pole 110v receptacle cover

Base with two, 3-pole receptacle covers: 110v at front; 208v in back

© 1959

Specify the Original HOPE GALVANIZED MALLEABLE IRON POLE BASE

Attractive, rugged lighting poles easily fabricated by combining HOPE threaded Bases with standard galvanized conduit. Four Base sizes permit your fixture and elevation selection for a limitless variety of installations. Tapped deep for strong, locking engagement with pipe thread. Ample chamber for conduit stubs, splicing, grounding. For complete Bulletin G-25, circle number 7 on the Graybar postcard.

HOPE ELECTRICAL PRODUCTS CO.

For excellent performance at very low cost— RAWLPLUG Universal Masonry Anchors!

Insist on the Rawlplug—the *universal* masonry anchor—usable in any masonry material! What's more, this jute fiber anchor can be used with wood, sheet-metal or lag screws, and the holding power is far in excess of most ordinary requirements. Requires only a small hole which means less drilling and less time consumed, since you usually can drill and insert the Rawlplug right through the fixture, without "hole-spotting".

Add these advantages to Rawlplug's low initial cost, and you'll specify Rawlplug every time. For illustrated literature showing the complete range of sizes available, as well as instructions for use, simply circle number 8 on the Graybar postcard.

THE RAWLPLUG COMPANY, INC.

WESIX-IONIX Wall Heaters feature:

- Air-Ionization control
- Relief from hayfever, asthma
- Air-borne bacteria destruction
- Completely automatic operation

Finished in decorative driftwood and ivory, the Wesix-Ionix heater shown here is only one of a complete line of modern, automatic heating units, in capacities of 1000, 1500, 2000 and 3000 watts.

Send today for our free catalog and other literature which gives complete specifications on all models. Simply circle number 9 on the Graybar postcard.

WESIX ELECTRIC HEATER COMPANY

INTERMATIC Time Controls for faster installation and greater reliability!

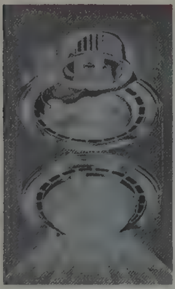
For reliable Time Controls, specify INTERMATIC, the unit that gives you all these time and money-saving features:

- 40-Amp rating—4,375 Watts Tungsten
- Snap-out mechanism for fast, easy mounting
- E-Z See Dial for rapid and accurate settings
- Front-Mounted motor to quickly check operation without removing entire mechanism
- 31 cubic inches wiring space prevents cramped and skinned fingers

There's an Intermatic Time Control for nearly every timing need. Get your free catalog showing models, specifications, etc. — circle number 9A on the Graybar postcard.

INTERNATIONAL REGISTER COMPANY

item... mail card to GraybaR!



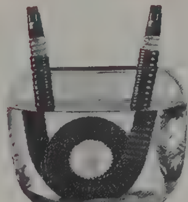
NuTone's VENT-A-LITE combines bathroom exhaust fan and light!

Now you can install one ceiling fixture that does two jobs. A bathroom exhaust fan plus a lighting fixture in one combination unit! NuTone's Model 8660 Vent-A-Lite includes a fan blower that is quiet and moves just the right amount of air without causing chilly drafts. It installs easily between 2" by 6" joists. Made of anodized aluminum which will not rust or tarnish.

A new NuTone color catalog, just off the press, describes all of the many NuTone door chimes, exhaust fans, range hoods, etc. Get yours, simply circle number 10 on the Graybar postcard.

NUTONE, INCORPORATED

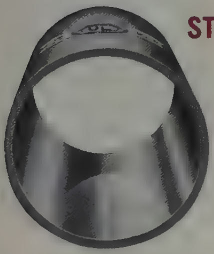
New C-L-X Cable by SIMPLEX gives complete protection!

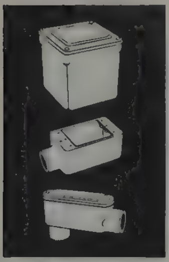


You may not have occasion to run cable through a fishbowl, but you'll still appreciate the protection afforded by Simplex' new advanced design cable system. It installs "as is", and provides complete, positive protection against liquids, gases, and mechanical damage. As pliable as unsheathed cable, it's available with continuous, corrugated sheaths of steel with outer plastic jacket; and aluminum, copper, or bronze—with or without outer plastic jacket.

Our complete 16-page Catalog Number 1043 gives you all the features and specifications of C-L-X Cable as well as case history reports proving its superior performance. Circle number 11 on the Graybar postcard for your free copy.

SIMPLEX WIRE AND CABLE CO.



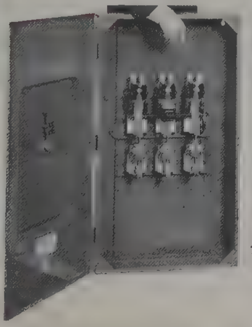


STRONG • LIGHT • NON-CORROSIVE
KRALOY
Rigid PVC Conduit and Fittings

Easier to handle, KRALOY CONDUIT reduces installation costs . . . solvent weld joints eliminate threading. Wires pull easier through the ultra-smooth walls without conductor damage. Kraloy is the first conduit to receive U.L. listing for direct underground burial or encasement in concrete.

NEW! Rigid unplasticized PVC Kralet fittings are now available in access, junction and FS boxes. For complete information describing Kraloy's advanced line of electrical conduit and fittings, circle number 12 on the Graybar postcard.

KRALOY PLASTIC PIPE CO.



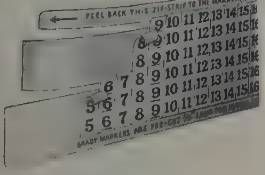
For fingertip safety...
FEDERAL PACIFIC
A-plus Safety Switches

Triple protection and fingertip operation! Exclusive with Federal Pacific's Type *A-plus* industrial safety switch. Visible blades *plus* the high current capacity of a circuit breaker *plus* the high interrupting capacity of fuses. And, it's rated for load break, not just disconnecting duty. Fingertip operation with quick-make, quick-break mechanism.

Federal Pacific heavy-duty industrial safety switches are available in 30 through 1200 amp ratings, 250 and 600 volts. Bulletin 1241 gives you all the specs; circle number 13 on the Graybar postcard.

FEDERAL PACIFIC ELECTRIC COMPANY

BRADY can save you 50% marking small-gage wires!

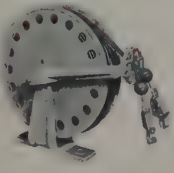

PEEL BACK THIS 210-STRIP TO THE MARKER(S) YOU
BRADY MARKERS ARE PRE-CUT ¾" LONG FOR

Brady pressure-sensitive, all-temperature wire markers for small-gage wires are exactly ¾" long, to fit wires under ¼" O.D. They cut your small-gage wire marking in half because: (1) they cost half the price of standard markers, and (2) they go on the wire twice as fast! What's more, they stick and stay stuck at temperatures up to 300° F.

Over 3000 stock markers are available. Send for your copy of our big new bulletin and free testing samples today. Circle number 14 on the Graybar postcard.

W. H. BRADY CO.

Hazardous location? Rely on Benjamin Grounding Reels for static discharge!

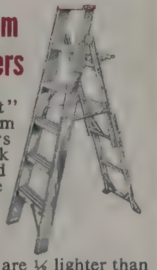


Depend on Benjamin for the most extensive line of Grounding Reels, for use at bulk handling stations, terminals, airport hangars, refueling depots, chemical plants, etc.—wherever generation of static charges is a problem! The series 3000 units shown here have an over-ride feature for the spring motor, and are available either with or without governor control. Model 600 AC has been designed to meet Airforce specification MIL-R-26872.

Get more information about Benjamin Grounding Reels as well as the complete line of electric extension Cord Reels, to meet every need. Just circle number 15 on the Graybar postcard.

BENJAMIN REEL PRODUCTS, INC.

Cut fatigue with "SUPERLIGHT"
Magnesium Stepladders

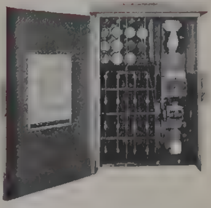


"Superlight" magnesium stepladders make work go faster and easier, since they weigh a fraction of comparable wood ladders and are ⅓ lighter than aluminum ladders. Magnesium ladders offer the best possible strength/weight ratio; are sturdily made with full deep channel rear section side rails, strong channel cross struts and diagonal bracing, and securely riveted steps. Hard rubber, non-skid feet provide sturdy support while avoiding floor marking.

Send for free literature showing the complete line, specifications and prices. Simply circle number 16 on the Graybar postcard.

WHITE METAL ROLLING & STAMPING CORP.

T-P ELECTRIC gives you Three-Phase Advantages on Single-Phase Lines!



Incorporate a T-P Phasing Unit with a three-phase motor and a standard fusible motor control and:

- Reduce initial and maintenance costs;
- Reduce starting surge on power line;
- Improve power factor;
- Eliminate need for heavy, expensive single-phase motors (Detach phasing unit when 3-phase service becomes available).

Choose from three models to fit any application. For complete information on all models, simply circle number 17 on the Graybar postcard.

T-P ELECTRIC & MFG. CORP.

For more information on any

Labels On-the-Spot... in Seconds!

Choose from 5 models . . . style M-2 illustrated.

Make your own professional labels for just pennies. The Dymo Mite tool embosses raised white letters and numbers on a variety of colored pressure sensitive plastic tapes . . . metal tapes, too!

Get more information about this complete color coding identification system for electrical panels, circuits, motor controls, stock bins, shelves . . . 1001 uses. We'll rush free literature if you'll circle number 18 on the Graybar postcard.

DYMO INDUSTRIES, INC.

Speed framing and suspension work with GLOBE Channel and Fittings!

Globe Channel and Fittings can be used for any framing or suspension purpose. Set-up with a hacksaw and wrench, Globe Channels are completely re-usable, can be unlocked and set-up again in another location. Triple grip lock nuts are furnished for greater strength and there is a fitting for any purpose. Fluorescent fixture hanger fittings, porcelain cable clamps, concrete inserts, pipe clamps, shelf brackets, beam clamps and flat plate fittings, as well as custom engineered fittings and accessories are available to suit every need.

For information and literature showing complete range of fittings and accessories, simply circle number 19 on the Graybar postcard.

THE GLOBE COMPANY

CORDLEY Water Coolers "Without Pipes" provide quick, neat, clean installations!

Install the *cleanest* water cooler service ever with Cordley's 1961 Cordwall line! All pipe connections are made inside and concealed; cabinets are flush to the wall, so trash can't collect behind. The complete line of 31 models includes 5 floor models of 6 to 22 gallon capacity, plus 3 wall models that make sweeping, hosing or waxing even easier. All this, with a complete cooler replacement 5-year guarantee!

Our new Form 6P61 Cooler Selector Guide and Catalog is ready now. For your copy, circle number 20 on the Graybar postcard.

CORDLEY & HAYES

Install the beauty and quality of SIERRA Quiet Switches!

SIERRA QT Switches with "Tite-Bite" Screw Terminals permit fast, visibly-positive wiring. 1" deep case provides wiring clearance. Heavy bronze current carrying parts plus oversize silver alloy contacts assure long life. Operates in any position. Ideal for incandescent or fluorescent loads; 80% of rating for motor controls. 1 to 4-way, toggle or key-operated. Circle number 21 on Graybar postcard for handsomely-illustrated catalog with complete information and prices.

SIERRA ELECTRIC CORPORATION

New INFRA-SAFE® Infra-Red Heaters for Tough-to-Heat Places!

Here's a new, heavy-duty weatherproof radiant heater for personnel heating in difficult to heat places. Perfect for large areas with high ceilings, truck docks, railroad stations, store fronts, outdoor barbeque areas, swimming pools, patios, bowling areas, etc. Gives you immediate heat, easily directed to troublesome spots. Does not heat the air; heats the person or object at which it is aimed. Available in 1,000 or 2,000 watts, 26" long; 2,000 or 4,000 watts, 46" long. For well-illustrated literature giving complete details, specifications and instructions on estimating requirements, circle number 22 on the Graybar postcard.

ENGELHARD HANOVIA INC.
HANOVIA LAMP DIVISION

CRC 2-26 . . . for Low-Cost Prevention of Electrical Failures due to moist and corrosive atmospheres

CRC 2-26 drives out moisture and seals the surface from subsequent re-entry of moisture. Corrosive action is stopped and prevented from recurring. Restores electrical characteristics (usually, with just one application) and prevents dimensional and resistance changes due to moisture. Will return its cost many times over in reduced downtime or time out for repairs due to moisture.

For more information, circle number 23 on the Graybar postcard.

CORROSION REACTION CONSULTANTS

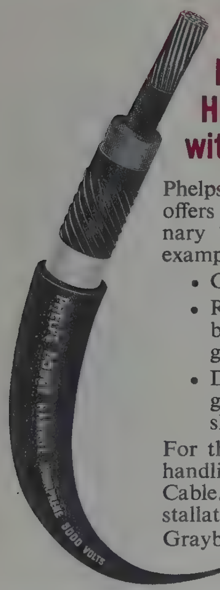
For low-cost installation and dependable operation, specify FEDERAL "Vibratone" Horns!

Here's a line of compact, powerful and self-adjusting electric horns that provide for the simplest installation imaginable. They mount in standard 4" square outlet boxes, either surface or plastered-in. Unit extends just 1⅛" beyond box. Includes volume control to adjust from a whisper to a 100 decibels. Modular accessories available provide 6 mounting variations for the 3 different models. Choice of AC or DC and wide-voltage varieties.

The complete line, along with dimensional and other data, will be at your fingertips if you write for our new Bulletin Number 105. Circle number 24 on the Graybar postcard.

FEDERAL SIGN & SIGNAL CORPORATION

item... mail card to GraybaR!



Want the finest?

Phelps Dodge Habirite-Habirprene Cable with Wire shield!

Phelps Dodge Habirite-Habirprene Cable offers a number of advantages over ordinary "RR" cable with tape shield. For example:

- Greater flexibility
- Rugged wire shield that can be braided or bunched for use as a ground lead
- Dependable wire shield continuity giving protection against hidden shield rupture.

For the ultimate in safety, durability and handling ease, specify Habirite-Habirprene Cable. And for sizes, specifications and installation data, circle number 25 on the Graybar postcard.

PHELPS DODGE COPPER PRODUCTS CORP.

The Safety Switch That Challenges Comparison...

BULLDOG'S General Duty Safety Switch

Minimum Arcing
Double Break Switching
Arc Control
Vacu-Break Principle
Pressure Contacts
Clampmatic Spring Action
Positive Switching
Direct Handle Operation
PLUS... All Current Carrying Parts Are Silvered

Available in NEMA 1 and NEMA 3R Enclosures . . . Competitively Priced. For complete information, circle number 26 on the Graybar postcard.

I-T-E CIRCUIT BREAKER COMPANY
BULLDOG ELECTRIC PRODUCTS DIVISION

Work is easier—goes faster—with Lightweight ALCOA Aluminum Conduit

A ten-foot length of 4-inch aluminum conduit weighs just 34 pounds—compared with 98 pounds for a similar section of steel conduit.

With Alcoa aluminum conduit, you have only ⅓ as much weight to lift, load, carry and erect. Also, you'll find that this conduit is corrosion-resistant, nonsparking, nonmagnetic, and neat appearing.

Specify Alcoa aluminum conduit on your next job. We'll help by sending you complete information on sizes, specifications, etc. Just circle number 27 on the Graybar postcard.

ROME CABLE • Division of ALCOA

For high flexibility WHITNEY BLAKE DYNAPRENE® the portable cord that does the job!

Check these features and you'll see why you should specify Dynaprene Portable Cords every time:

- Accurate centering
- No flat spots
- Long flex life
- Even cure
- High flexibility
- High tensile strength
- Flame retardant jacket
- High resistance to cutting and abrasion
- Superior resistance to sunlight, aging, ozone and heat
- Resists oil, solvents and acid fumes

For more information and specifications, just circle number 28 on the Graybar postcard.

WHITNEY BLAKE COMPANY

ZEUS Portable Electric Power—Electricity... any time... anywhere!

Zeus portable electric generators in two sizes—1250 and 3000 watts—now give on-the-spot power to contractors, builders, campers, sportsmen . . . and provide standby electricity to farmers and homeowners.

The ZEUS GB-125 weighs only 76 pounds, giving true portability to its 1250 watts, 60-cycle AC, output.

ZEUS GW-300 features both 230 and 115 volt service with 3000 watts of 60-cycle AC power. Weight: 180 lbs.

Built and backed by Borg-Warner, the powerful Zeus employs Permanent Magnet Alternators, eliminating failures and maintenance common to brush and commutator designs.

We'll be glad to send you our complete catalog showing the models available and their superior features. For your free copy, circle number 29 on the Graybar postcard.

Pesco Products Division • BORG-WARNER CORPORATION

Test insulation resistance speedily and accurately with MEGGER® Testers!

Rely on Megger® Insulation Testers for convenient, accurate measurements. One selector switch gives you choice of Megohm Scale (÷1 + ÷10), Ohm Scale, and Capacitance Discharge.

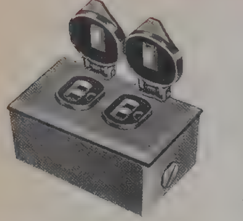
The versatile line includes hand-operated and rectifier-operated instruments, in ranges up to 2000 megohms and 1000 volts DC, with or without the above features. Double voltages also now available in Meg® Type instruments with ranges of 0-1000 megohms at 500 volts DC and 0-2000 megohms at 1000 volts DC.

Our Bulletin 21-45 gives you complete specifications on all models. For your free copy, circle number 30 on the Graybar postcard.

JAMES G. BIDDLE CO.

For more information on any

For every weatherproof requirement... BELL Deluxe Devices, Covers and Boxes!



For your weatherproof applications, specify Bell, with the patented Saf-T-Lok cover! Stays in open position when desired; easily snaps shut with slight finger pressure.

Bell switches and solid brass weatherproof covers are available from one to ten gangs in any combination of devices desired. Use with Bell aluminum boxes, one or two gang, 3 to 7 hubs, ½" or ¾" diameter. For complete catalog, circle number 31 on the Graybar postcard.

BELL ELECTRIC COMPANY

Code wires instantly with SLIPKNOT Plastic Color Coding Tape

Slipknot plastic color coding tape is thin, weather-resistant and color-fast—as well as inexpensive. Provides instant identification under all conditions, accommodates any diameter wire or conduit, and conforms perfectly to irregular shapes. Six standard colors are available in one handy dispenser in accordance with existing electrical codes, all rugged enough to withstand fishing through conduit. In short, the perfect, convenient on-the-job method of color coding.

Send for illustrated literature showing available colors and handy dispenser. Circle number 32 on the Graybar postcard.

PLYMOUTH RUBBER COMPANY, INC.

KAISER Master LAYTEX® Portable Cords outlast other cords 3 to 1!

More than 12,000 tests, in the laboratory and in rugged plant installations, show Kaiser Master Laytex Cords give you these key advantages:

- 33% greater heat resistance
- 197% greater impact resistance
- 58% greater abrasion resistance
- 50% greater resistance to cutting
- 118% greater resistance to tearing
- 38% greater breaking strength
- 26% greater oil resistance
- 488% greater resistance to flexing

In short, Kaiser Master Laytex Portable Cords give you longer life than even a hypothetical cord combining the best features of all cords tested! Cords are available in 600-volt, heavy duty, Number 18 through 10 sizes; 300-volts, light-duty, Number 18 and Number 16 sizes. Conform to all industry practices concerning jacket thickness and overall diameter. Listed and labeled by Underwriters' Laboratories, Inc.

Our free 24-page booklet gives you all the information you need to choose the right cord every time. Simply circle number 33 on the Graybar postcard.

KAISER ALUMINUM & CHEMICAL SALES, INC.

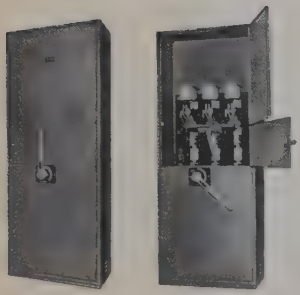
Looking for dependability in flashlight and lantern batteries? SPECIFY MARATHON–famous for endurance

Remember Pheidippides? He's the Greek who ran from Marathon to Athens in 490 B.C., giving to the word "Marathon" its connection with endurance and rugged performance.

MARATHON flashlight and lantern batteries have exactly this built-in endurance—a quality that makes them outstanding in performance and reliability. The complete line includes flashlight and lantern batteries of all types, including the famous No-Leak Lantern Battery. They are all described in our well-illustrated catalog. For your free copy, along with our Industrial Specification Sheet, circle number 34 on the Graybar postcard.

MARATHON BATTERY CO.

For maximum current carrying and load interrupting characteristics... BOLT-LOC® PRESSURE CONTACT LOAD BREAK SWITCHES

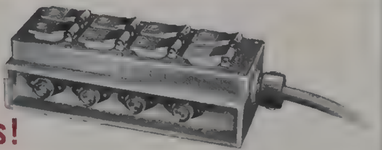


Here's a line of pressure contact load break switches for service entrance, feeder and industrial use that far exceeds maximum operational and safety requirements. Will interrupt extremely high short circuit currents when equipped with current limiting fuses. Furnished standard with quick-break mechanism, replaceable arcing tips, and double slot steel plate arc quenchers. For 1200 to 4000 amperes, 240 and 600 volts. Available unmounted or in free-standing or wall-mounted NEMA 1 enclosures; also, dust-tight and outdoor enclosures.

Our BOLT-LOC Bulletin Number 101 describes the complete line and illustrates all the built-in advantages of these unsurpassed switches. For your copy, circle number 35 on the Graybar postcard.

BARKELEW ELECTRIC MFG. CO.

NEW! Solve your portable power needs!



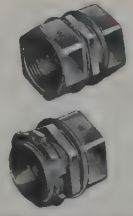
New from Woodhead! #3010 Series Heavy Duty "Safety Yellow" Multi-Tap Portable Outlet Boxes for four single or duplex receptacles. Available with various options, such as weatherproof covers and fuse holders to allow fusing of each outlet. Permits gang operations with individual circuit protection.

All rubber parts are Woodhead "Safety Yellow" Neotex for greater safety, lower maintenance cost.

This new Multi-Tap supplements the #910 Cord Reel and #3000 Series Outlet Boxes in providing portable multiple outlets. We'll be glad to send you complete, illustrated literature. Circle number 36 on the Graybar postcard.

DANIEL WOODHEAD COMPANY

Wagner Pressure Cast Compression Type EMT competitively-priced, quality CONNECTORS and COUPLINGS



The line that electricians prefer! Wagner Pressure Cast compression type EMT connectors and couplings are made of the highest grade zinc base alloy, have excellent surface finish, and high resistance to atmospheric corrosion. These qualities, combined with mechanical strength needed to do the job, give you a line of connectors and couplings usable wherever rolled zinc or galvanized iron has been used in the past. Listed by Underwriters' Laboratories.

Write today for a complete listing of types, specifications and prices. Just circle number 37 on the Graybar postcard.

WAGNER MALLEABLE PRODUCTS CO.

item...mail card to GraybaR

"800" Series—Standard

New NATIONAL ELECTRIC Floor Boxes accept widest range of flush floor receptacles!

National Electric's new "800" Series Standard Floor Box and "800-CI" Series Cast Iron Floor Box accept the widest range of flush floor receptacles through 20 amps, with standard service fittings to take receptacles through 50 amps. Plus: larger hand-hole for easier fishing and mounting ring for easy field installation of intercom and low-potential jacks. And, the "800-CI" Series Floor Box is designed for positive waterproof installation.

What's more, you get all this with no increase in price! Find out more about these versatile units. We'll send complete literature if you circle number 38 on the Graybar postcard.

NATIONAL ELECTRIC DIVISION
H. K. PORTER COMPANY, INC.

"800-CI" Series—Cast Iron

For maximum safety and security... the all-new KELLEMS DELUXE CORD GRIP!

Eliminates direct tension pull on electrical terminals—controls arc of bend.

Prevents breakdowns on:

- Portable Tools and Machines
- Pendant Drop Stations
- Cranes and Hoists
- Pumps and Compressors
- Outdoor Electrical Boxes

The complete line of safe, secure Kellems Grips is described fully in our latest 24-page catalog. Your copy is free for the asking. Simply circle number 40 on the Graybar postcard.

THE KELLEMS COMPANY, INC.

FREE Introductory offer (90c value) New Wire-Pulling Compound

Yes, Sir... You get a FREE piggy-back quart of SLIKON with every gallon ($2.88).

Try the quart... if you're not satisfied, return the gallon to your local Graybar distributor and get your money back.

Offer good for a limited time only. And for more information about Slikon, circle number 41 on the Graybar postcard.

Slikon never hardens... never settles, or evaporates in the can.

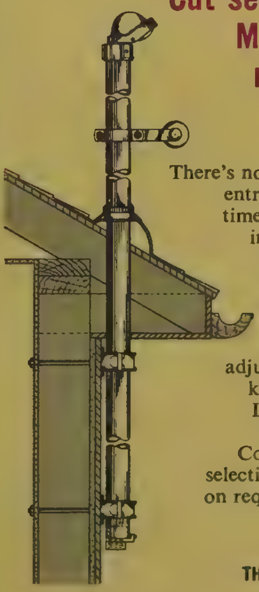
BURNDY CORPORATION

New LEVITON 20-Ampere Grounding Devices meet revised National Electric Code!

Here's the new 5800 Series of 20-amp grounding devices from Leviton, designed to meet the heavy duty requirements of modern equipment, appliances and portable tools. The line includes single and duplex receptacles; also available with round covers, and a U-Ground cap. Special configurations of both receptacles and caps comply with 1959 Code revisions, limiting use of electrical equipment to 125V, and no more than 20 amp. Constructed to Leviton Heavy-Duty Specification Grade Standards, the new devices feature shallow bodies, side wiring, break-off links, double grounding screws, and rust-proof covers for both 3¼″ and 4″ outlets. All devices listed by Underwriters Laboratories, Inc.

This is only one of many Leviton products that will help you do a better job. They are all described in our new 16-page catalog, complete with price list. For your copy, circle number 42 on the Graybar postcard.

LEVITON MANUFACTURING COMPANY, INC.



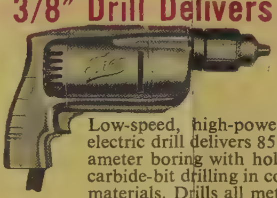
Cut service entrance costs! M & W MAST KITS make installations faster, easier!

There's no faster, easier way to make service entrance installations than with handy, time-saving M&W Mast Kits. Each kit includes all the fittings you need for the job: no waste, no lost time, no extra costs. Kits for 1¼, 1½, 2 or 2½″ conduit, including split-clamp conduit support, or one-hole strap with lag screws, and flashing with adjustable seal. You save, too, because kits cost less than individual fittings. Look to M&W, too, for a complete line of service entrance fittings.

Complete literature showing the wide selection of all M&W fittings is available on request. For your copy, circle number 43 on the Graybar postcard.

THE M. & W. ELECTRIC MFG. CO., INC.

For more information on any item...mail card to GraybaR!



3/8″ Drill Delivers 85% More Torque For Hole Sawing, Concrete Drilling

Low-speed, high-power industrially rated ⅜″ THOR electric drill delivers 85% more stall torque for large diameter boring with hole saws or fly-cutter bits, and for carbide-bit drilling in concrete, plaster, and other building materials. Drills all metals.

THOR No. 16FDH "Silver Line" ⅜″ drill weighs only 4¾ lbs., free speed 850 R.P.M.

For complete information, circle number 44 on the Graybar postcard.

THOR POWER TOOL COMPANY

Now! Reduce impact shock with Ramset's new "SHURE-DRIVE" Hammer!

Now you can hammer steel; fasten to concrete and other hard-to-penetrate materials quickly and easily, without shock or fatigue! Designed for use with the "Shure-Set" hammer in fastening tools, the "Shure-Drive" hammer features a new design by which the head is suspended from the handle by elastic shocks or "O-Rings". These resilient rings absorb the energy and reduce impact shock to a minimum. In addition, the neoprene-covered metal handle provides a non-slip, non-twist grip.

For full information about this new Ramset hammer, circle number 45 on the Graybar postcard.

RAMSET FASTENING SYSTEM
OLIN MATHIESON CHEMICAL CORPORATION

5 Reasons ILG Propeller Fans Are Your Best Buy!

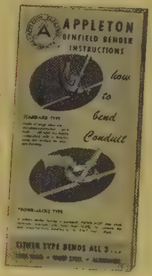
Only ILG Propeller Fans give you all of these features:

1. Self-cooling keeps the motor clean and cool-running for long life.
2. Exclusive ILG "Q" fan wheel provides both quiet operation and high air capacity!
3. Permanent-split capacitor ILG motors with sealed ball bearings give years of maintenance-free, dependable operation.
4. Most complete range of fans . . . size 6″ to 48″ . . . one and two-speed.
5. Certified AMCA ratings.

For free 20-page catalog giving complete specifications, circle number 46 on the Graybar postcard.

ILG ELECTRIC VENTILATING CO.

Bend conduit faster and easier! *Free* booklet from APPLETON shows you how!



APPLETON BENFIELD BENDER INSTRUCTIONS

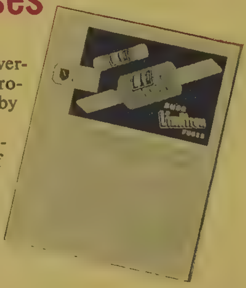
how to bend Conduit

Here's a helpful 12-page booklet giving complete instructions on how to make precision bends quickly in electrical metallic tubing, rigid steel, and rigid aluminum conduit. Full particulars on how to make the five fundamental bends—angle, stub lengths, back-to-back, offsets, and "3 bend" pipe saddles. Dozens of diagrams clearly illustrate the proper technique in every case. Also, you get offset formulas, shrink tables and "gain" tables that help even an apprentice bend conduit like an expert.

For your copy, circle number 47 on the Graybar postcard.

APPLETON ELECTRIC COMPANY

New Bulletin from BUSSMANN on High Interrupting Capacity Current-Limiting Fuses



Buss Limitron Fuses

A new application bulletin is available covering Buss LIMITRON Fuses, used for protection of circuits and equipment served by high capacity systems.

Limitron Fuses have interrupting capacity of 200,000 amperes, with limitation of fault current to very low values. They are made in sizes to fit all National Electric Code fuseholders, 1 to 600 amperes, 250 and 600 volts, and for stud mounting 601 to 6000 amperes, 600 volts or less.

Special types, engineered for the needs of specific equipment, include a complete line for protection of semi-conductor rectifiers, fuses for power-factor correction capacitors, fuses for use in fused circuit breakers, and small dimension types for special uses.

Charts showing time of opening and current limiting effect characteristics are useful in selecting proper fuses to protect equipment and to secure coordination of protective devices.

For this new bulletin, circle number 48 on the Graybar postcard.

BUSSMANN MFG. DIVISION
McGRAW-EDISON COMPANY

CALL GRAYBAR FIRST FOR . . .

. . . all of the "bread & butter" items you need and use daily.

. . . the latest tools and specialties—many developed for and by electrical contractors—to help speed jobs and cut costs.

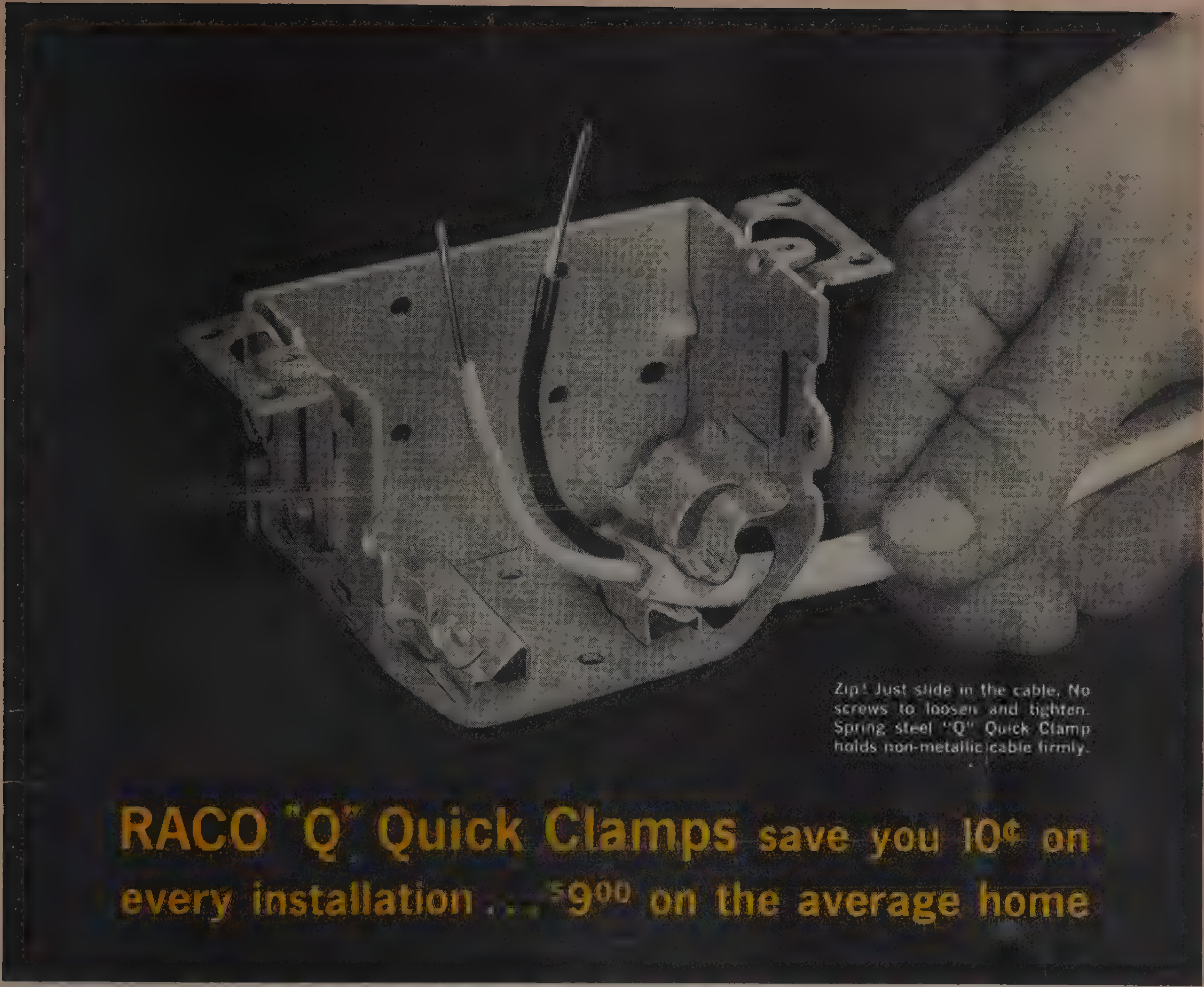
. . . the complete line of famous ACTION Lighting Fixtures—all made by leading manufacturers—priced low to sell like hot cakes—engineered to reduce installation time—designed to deliver the most efficient lighting—in-stock to assure fast delivery.

. . . electrical space heating equipment—a complete and diversified selection—for all requirements and types of installations.

In short,

CALL GRAYBAR FIRST FOR EVERYTHING ELECTRICAL

Distributed by GraybaR ELECTRIC COMPANY

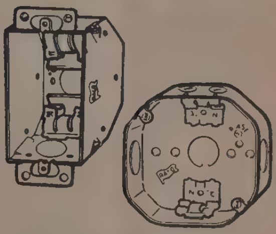


Zip! Just slide in the cable. No screws to loosen and tighten. Spring steel "Q" Quick Clamp holds non-metallic cable firmly.

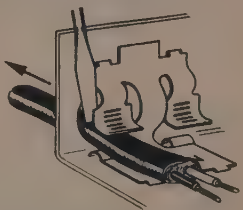
RACO "Q" Quick Clamps save you 10¢ on every installation ... $\$9^{00}$ on the average home

Now...a new, faster way to install non-metallic cable...and save on every job. With the new RACO "Q" Quick Clamp, you just slide the cable in. No screws or screwdrivers. Holds cable tightly. Available in square-cornered switch boxes, beveled corner switch boxes and outlet boxes.

*Trade Mark



Available in switch boxes (including beveled corner boxes) and outlet boxes.



To remove cable, release clamp pressure with screwdriver.

RACO

ALL-STEEL EQUIPMENT INC.
Aurora, Illinois

Naugatuck KRALASTIC®

Here's why large East Coast utility chooses **KRALASTIC** conduit

Ease of use Unlike the wood moldings and rigid type of conduit normally used, KRALASTIC conduit can be flexed to follow irregularities of pole or mounted equipment, saving many needless breaks or fittings. It is simply and quickly cut to length with a hacksaw, securely stapled in place. And conduit of KRALASTIC is easy to handle because it's lighter than aluminum.

Protection KRALASTIC is an excellent electrical insulator. It is extremely tough, even in thin-wall sections, in this case allowing reduction in conduit diameter from the previously used 2" to 1". It not only requires less material, but is less bulky and easier for linemen to climb around. KRALASTIC's unusual toughness protects against accidental damage from linemen as well as storms and other causes. And, of course, KRALASTIC can't rust, rot, or corrode, withstands weather at its worst.

Economy Because extruded KRALASTIC conduit is relatively inexpensive, unusually easy to work with, and extremely durable, it provides important savings in all areas.

What's *your* line? If it involves piping or conduit, it might well call for KRALASTIC... the original ABS plastic that has proved its superiorities in nearly 10,000 miles of piping installations, in other products from baby combs to football helmets. Better look into KRALASTIC *now*.

United States Rubber
Naugatuck Chemical Division
234K ELM STREET
NAUGATUCK, CONNECTICUT

KRALASTIC RUBBER-RESINS • **MARVINOL** VINYLS • **VIBRIN** POLYESTERS

Akron · Boston · Chicago · Gastonia · Los Angeles · Memphis · New York · Phila. · CANADA: Naugatuck Chemicals · Elmira, Ont. · Cable: Rubexport, N.Y.

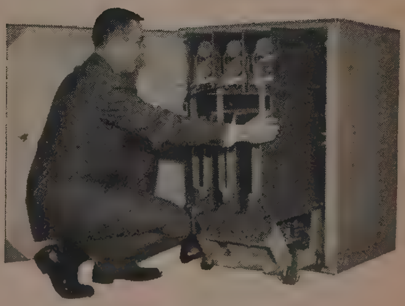
ALLIS-CHALMERS

New *SpaceMaker* control is the first completely new high-voltage motor controller in more than a decade. It is the first two-high, 2 to 5 kv control center, and the first in its voltage class with complete drawout construction for unprecedented safety and accessibility.

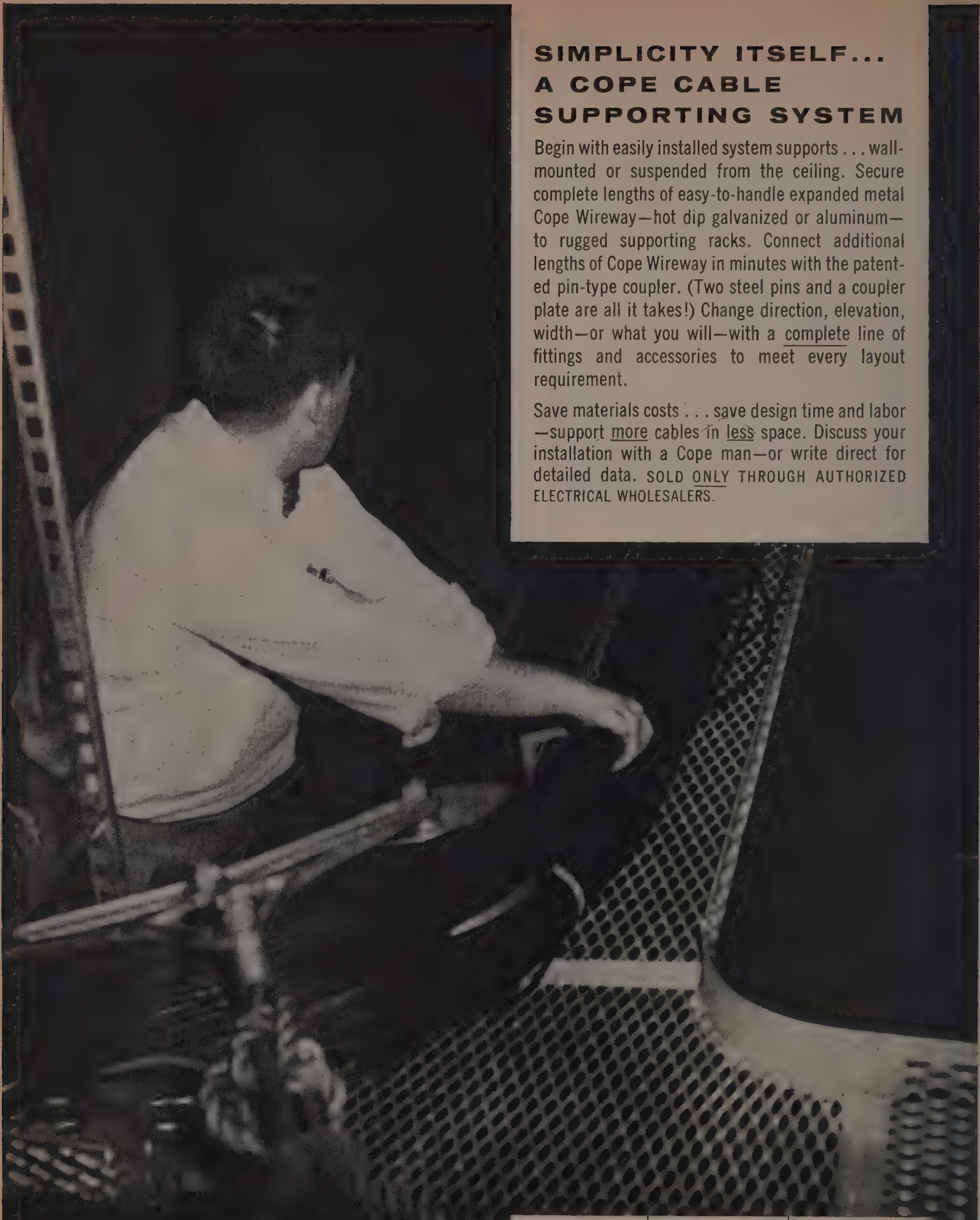
Inspection and maintenance are greatly simplified. One man can easily roll the carriage from the control enclosure for complete accessibility. Arc chutes and barriers lift out and the pole pieces rotate to expose the contact structure.

And, SpaceMaker control is completely safe. It is impossible to come in contact with "live" parts because the contactor is connected and disconnected with the door closed and live line connections are isolated by automatic shutters.

For complete details of the new, years-ahead SpaceMaker *controller, call your nearby A-C representative. Or write* **Allis-Chalmers,** *Industrial Equipment Division, Milwaukee 1, Wisconsin.* A-1406



SpaceMaker is an Allis-Chalmers trademark.



SIMPLICITY ITSELF... A COPE CABLE SUPPORTING SYSTEM

Begin with easily installed system supports . . . wall-mounted or suspended from the ceiling. Secure complete lengths of easy-to-handle expanded metal Cope Wireway—hot dip galvanized or aluminum—to rugged supporting racks. Connect additional lengths of Cope Wireway in minutes with the patented pin-type coupler. (Two steel pins and a coupler plate are all it takes!) Change direction, elevation, width—or what you will—with a complete line of fittings and accessories to meet every layout requirement.

Save materials costs . . . save design time and labor —support more cables in less space. Discuss your installation with a Cope man—or write direct for detailed data. SOLD ONLY THROUGH AUTHORIZED ELECTRICAL WHOLESALERS.

TJ COPE DIVISION ROME CABLE CORPORATION / Collegeville, Pa.

Dept. G

ORIGINATORS OF FIRST INTEGRATED LINE OF CABLE SUPPORTING SYSTEMS

SILICONE NEWS from Dow Corning

Now I'm In Little League

Since We've Converted "Down-time" to "Spare-time" by Specifying Silicones

Three years ago, when Little League baseball was organized in our community, I was interested. Because I'm a family man with three boys, and I'd been a fair ball player, I was asked to manage a team. I wanted to help, but with my job, I knew I wouldn't have the time.

You see, I'm maintenance manager at the local foundry and metal working plant. We have more than 1500 integral horsepower motors. When a motor burns out, it has to be replaced immediately. With the increased frequency of failure in the summer . . . plant temperatures skyrocket . . . my time is not my own.

One day I saw a Dow Corning advertisement about silicone insulated motors. I wrote them and got all the information . . . technical data, too. After studying the material, I suggested to management we run our own life tests by having our problem motors rewound with silicones instead of with Class B insulation, as we were doing.

Result: we now specify silicone insulation in all of our motors exposed to heavy duty cycles, shock loads, frequent start-stop-reverse operation, high ambient temperatures and humidity. Savings are around $5000 a year . . . *not counting the savings in production and maintenance time.*

The sharp reduction in motor maintenance has given me some free time. This summer I managed a Little League team. By the way, my oldest boy looks great at second base, and he's no slouch at the plate.

Say, why don't you write Dow Corning for their literature on silicone insulated motors and transformers? I'm glad I did.

(This fictional story is based on actual plant experience with silicone insulation. Name provided on request.)

For information on silicone insulated motors, write Dept. 2814

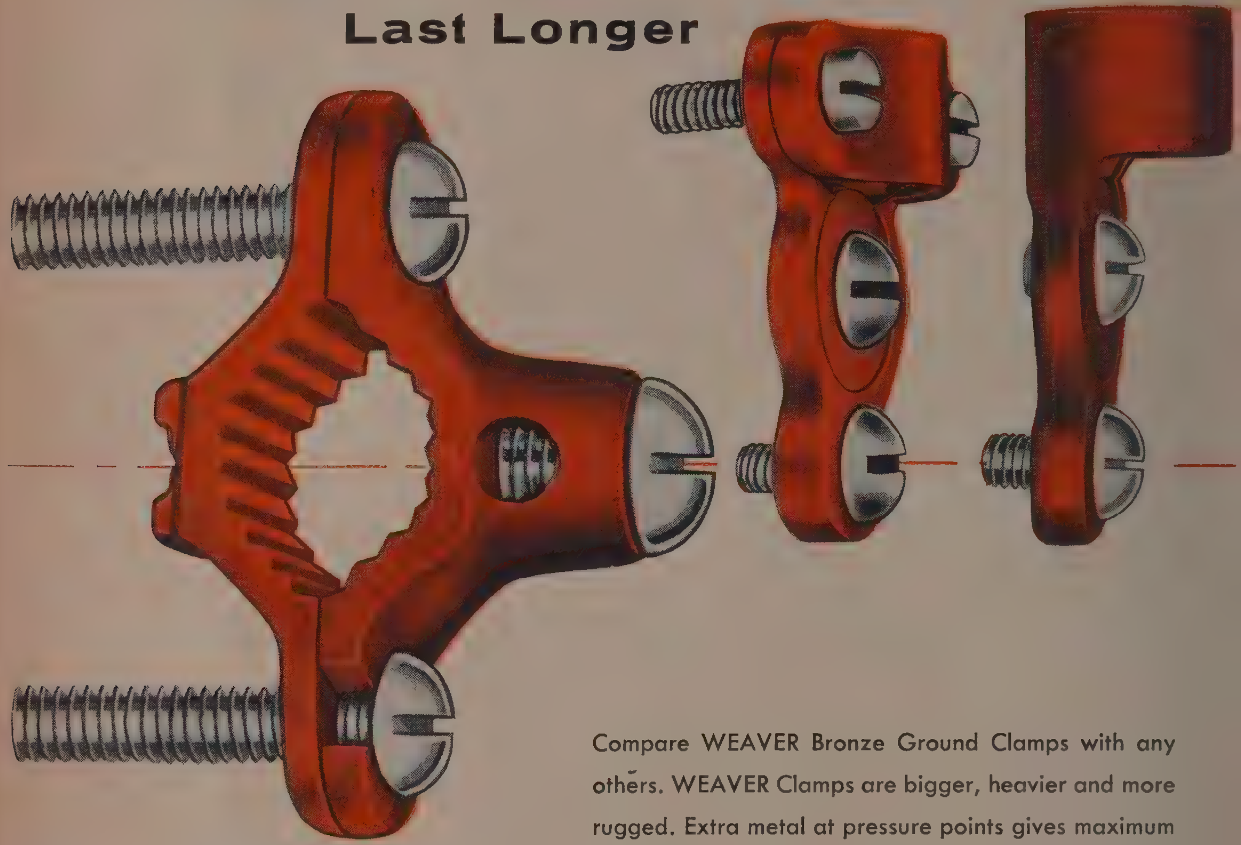
first in silicones

Dow Corning CORPORATION
MIDLAND, MICHIGAN

ATLANTA BOSTON CHICAGO CLEVELAND DALLAS LOS ANGELES NEW YORK WASHINGTON, D. C.

WEAVER
BRONZE GROUND CLAMPS

**. . . Easy to Install,
Last Longer**



Compare WEAVER Bronze Ground Clamps with any others. WEAVER Clamps are bigger, heavier and more rugged. Extra metal at pressure points gives maximum strength . . . increases conductivity. The all-bronze construction with heavily cadmium-plated screws prevents rust and corrosion . . . assures safe, permanent grounding. Swinging top eliminates loose parts to assemble and cuts down installation time. Only 3 types cover every grounding job. Sizes for ¼" through 4" copper or galvanized pipe.

*Ask your Electrical Wholesaler For
Weaver Bronze Ground Clamps*

J. A. WEAVER Company

2110 Howard Street • St. Louis 6, Mo. • GArfield 1-6336

Lawn-Glo Lights Provide Quality
or Home, Commercial Applications

One of L-M's newest Lawn-Glo lights, the Style C, provides soft, even light for this enchanting patio. Choice of six decorator colors and natural brushed aluminum.

Another new Lawn-Glo, the Style B, is this wall mounted unit. Lamp socket is an integral part of reflector and simply disconnects from the lighting fixture. Lawn-Glos accommodate standard lamps to 150 watts.

ine Material has added two more matching styles to its outstanding line of awn-Glo lights. This gives you a choice of excellent quality units. They offer wide potential for both home applications and commercial uses: provide oft lighting and smart appearance for motels, hotels, swimming pools, patios, alks and driveways, drive-in restaurants, amusement and public parks.

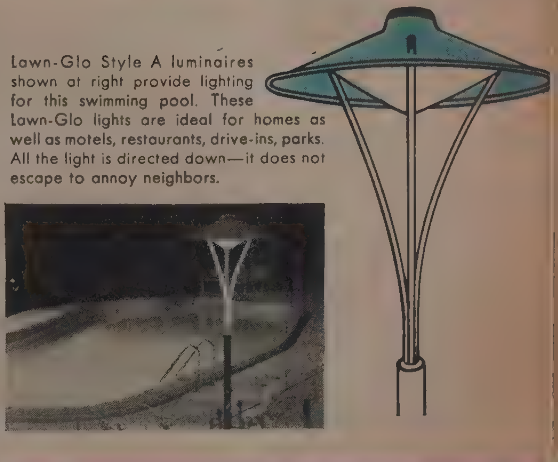
ligh Quality, Excellent Features

-M's Lawn-Glo lights are distributed exclusively through electrical whole-alers. These attractive lights have non-corrosive aluminum and plastic con-truction throughout. Post-top models are available with either natural red-vood or black metal posts as an accessory. Photocontrol available, auto-natically turns lights on at dusk and off at dawn.

-M Provides Promotion, Service

Iere's an excellent opportunity for you to increase your profits by specifying nd installing this outstanding line of outdoor lighting equipment. L-M offers nany other types of units, plus national advertising, sales tools, sales helps—ven outstanding application engineering service for larger jobs, available hrough Authorized L-M Distributors. Check your electrical wholesaler, or nail the coupon. 494 "Lawn-Glo" is a Line Material trademark.

Lawn-Glo Style A luminaires shown at right provide lighting for this swimming pool. These Lawn-Glo lights are ideal for homes as well as motels, restaurants, drive-ins, parks. All the light is directed down—it does not escape to annoy neighbors.



LINE MATERIAL® Industries

McGRAW-EDISON COMPANY

Quality Outdoor Lighting

McGRAW EDISON

DISTRIBUTION TRANSFORMERS · RECLOSERS, SECTIONALIZERS AND OIL SWITCHES
FUSE CUTOUTS AND FUSE LINKS · LIGHTNING ARRESTERS · POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS · CAPACITORS · REGULATORS · OUTDOOR LIGHTING
LINE CONSTRUCTION MATERIALS · PORCELAIN INSULATORS · FIBRE PIPE AND CONDUIT

MAIL THIS COUPON

Line Material Industries, Lighting Division,
Milwaukee 1, Wisconsin ECM-21

☐ Complete information on the Lawn-Glo line
☐ Complete information on L-M Outdoor Lighting

Name ____________
Title ____________
Company ____________
Address ____________
City ____________ *State* ____________
My Electrical Wholesaler is ____________

"Don't send a pony to do a horse's job"

A conversation you might hear around any good raceway.

Man with necktie: "WOW! It seems a lot higher once you're up here. Okay. Let's get this over with. Tell me. Why *steel* conduit instead of . . . ?"

White shirt: "Mainly because steel is stronger and gives us excellent protection against damage to conductors."

Work shirt: "It's easy to install. You can thread with regular dies, and you don't need special lubricants."

Necktie: "Well, that ought to do it. I just wanted a few facts to put in a report I'm making. Let's go back down and . . ."

Work shirt: "You don't have to baby steel conduit. You can bend it without worrying about it flattening out or crinkling."

Necktie: "Fine. Okay, let's get down off . . ."

White shirt: "Steel conduit can be installed in all atmospheric conditions and hazardous locations."

Necktie: "Well, that wraps 'er up. Let's go down and . . ."

Work shirt: "You don't have to give steel any special coating for concrete installations."

Necktie: "I've never been up on one of these things before . . . feel a little shaky . . ."

White shirt: "Steel conduit provides a grounded metallic system; induced currents are drained off without danger."

Necktie: "Let's go down."

Work shirt: "Steel conduit has a smooth interior . . . makes it easy to pull wires. Saves time and money."

Necktie: "Let's go down."

White shirt: "We wouldn't use anything *but* steel conduit here. You know . . . don't send a pony to do a horse's job. Okay. Want to go down?"

Necktie: "Yes . . . yes . . . steel conduit . . . certainly!"

America's leading steel pipe manufacturer supplying America's foremost conduit manufacturers.

This mark tells you a product is made
of modern, dependable Steel.

TRADEMARK

National Tube
Division of
United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
United States Steel Export Company, Distributors Abroad

now get this!

THE NEW CRIMP ESPECIALLY MADE FOR TODAY'S **LARGER WIRE SIZES** AND COMBINATIONS

NEW SIZE "WRAP-CAP"

CRIMP CONNECTOR

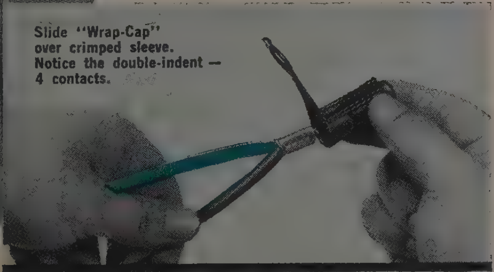
Contractors told us: "We like "Wrap-Cap" — the way it gives us all-around insulation. It wraps-up the joint in a jiffy" . . . "There's nothing to go wrong. The cadmium-plated steel sleeve doesn't slip, loosen or puncture" . . . "WHY CAN'T WE HAVE 'EM IN A SIZE FOR ALL THE BIG NEW WIRES AND COMBINATIONS?"

Now you *can* have "Wrap-Cap" and sleeve in a new *larger size.* It's the *first* crimp connector ever listed by UL across the board as 600V pressure cable connector (1000V for signs and fixtures) for every combination from one No. 14 and one No. 16 to one No. 6 and two No. 8. Can be used in 1027 combinations of solid and/or stranded wires in all!

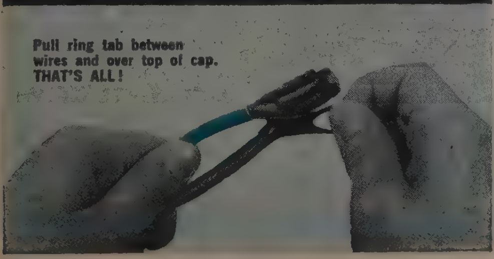
You'll get the same kind of diaper-wrap insulator that contractors have bought by the millions. Only now it's stronger than ever and triple-ribbed for extra tension, with a wider, longer skirt.

And you'll get the same vibration-proof cadmium-plated steel crimp sleeve you've proved best under all conditions. Only now it's longer, to give you *double* indents (4 contacts) at right angles to the wire, can't ever slip or loosen.

No tools needed except regular Ideal Electricians Pliers with crimping die.



Slide "Wrap-Cap" over crimped sleeve. Notice the double-indent — 4 contacts.



Pull ring tab between wires and over top of cap. THAT'S ALL!

FOR THE BEST CRIMP CONNECTOR YOU'VE EVER SEEN OR USED, CALL YOUR IDEAL DISTRIBUTOR OR TRY IT AT OUR EXPENSE.

SOLD THROUGH AMERICA'S LEADING DISTRIBUTORS
IN CANADA: Irving Smith, Ltd., Montreal

MAIL COUPON FOR FREE SAMPLES TODAY!

IDEAL

IDEAL INDUSTRIES, INC. 5224-B Park Ave., Sycamore, Ill.
Please send samples of your new size "Wrap-Cap" crimp connector.

Name__________

Company__________ Title______

Address__________

City__________ Zone____ State______

NOW . . . a simple, effective, low cost method of preventing electrical failure due to moist and corrosive atmospheres

CRC® FORMULA **2·26**

FOR THE ELECTRICAL INDUSTRY

TYPICAL EQUIPMENT MAINTAINED BY CRC 2-26

Switchgear
Circuit breakers
Contactors
Fuses
Relays
Solenoids
Rectifiers
Transformers
Instruments
Motors
Generators
Cables
Insulation
Coils
Timers
Conduits
Fixtures
Panelboards
Blowers
Signals
Controls
Recorders
Shielding
Counters
Housings
Chassis
Oscillators
Rheostats
Sub-assemblies
Synchronizers
Transmitters
Receivers
Ignition systems
Microphones
Tubes
Welders

Failure of physical or electrical characteristics of electrical and electronic equipment is often due to moisture and corrosion. Without effective moisture protection, deterioration sets in, leading to costly downtime, expensive repairs and high replacement incidence.

Dual-action CRC 2-26 eliminates or greatly reduces these failures. It displaces moisture on surfaces—gets into grain boundaries, cracks and pores—and leaves a thin, continuous molecular film that both stops and prevents corrosive action on metals, plastics, rubber, plated and painted surfaces.

Dimensional characteristics, contact resistance and other electrical constants remain unchanged. CRC 2-26 does not become dry, brittle or hard. Because it is non-irritating, non-toxic and has a high flash point, CRC 2-26 is easily applied without special precautions. It is used to maintain equipment year after year that formerly burned out or needed extensive servicing every few months.

Write for complete information to Corrosion Reaction Consultants, 116-A Chestnut St., Philadelphia 6, Pa., or telephone WAlnut 5-0200.

A SUBSIDIARY OF THE CHAS. J. WEBB SONS CO., INC.

Place your order now with your Electrical Distributor

Supplied in 16 oz. aerosol cans, 1 and 5 gal. cans, 55 gal. drums

UL

CRC® **2·26** LOW COST PROGRAMS FOR PREVENTIVE MAINTENANCE

Is your plant next?

If you've ever thought that this couldn't happen to your plant, a few facts may quickly change your mind. It can and *does* happen to 305 industrial plants every day! Staggering? so are the losses, $52,260,000 worth every year.

But your plant needn't be chalked up as just another statistic! You can do something about it!

First, let's consider the cause of such large loss fires. It's a known fact that one of the main reasons small fires become blazing infernos is — *the delay in reporting the discovery of a fire or immediate notification to the local fire department.* The chart below is a grim, factual reminder of

What happens when an alarm is delayed*

Property	Minutes Delayed	Reason for Delay	Loss†
Creamery	◔	Could not find alarm box	$75,000
Woodworking plant	◑	Discovered by passerby	$101,000
Wire & cable plant	◔	Employee tried to extinguish	$395,000
Ore refinery	◑	Employee tried to extinguish	$250,000
Lumber yard	◑	Employee tried to extinguish	[illegible]
Rubber plant	◔	Fire destroyed telephone	[illegible]
Rubber warehouse	◔	Telephone alarm, wrong address given	$55,000
Metalworking plant	◑	No alarm system	$245,000

†Includes loss of buildings, material and equipment, but not loss of business records and other intangibles.

What you can do

Provide your plant with *complete* protection with a Gamewell FLEXALARM system that *identifies* the *zone location* of the fire, and one that can be *directly connected* with the *Municipal Fire Department.*

A FLEXALARM system can be pre-engineered to meet the precise needs of your plant. FLEXALARM is available as a coded or non-coded system, semi or completely automatic, with practically limitless possible combinations of annunciators, special drill, test and alarm features. For example, it can be tied into the municipal alarm system at the curb; integrated with the sprinkler system; or automatic fire detection devices. It's simple to specify, easy to install, efficient and economical.

Specify Gamewell . . . for maximum protection at minimum cost. Write THE GAMEWELL COMPANY, 1315 Chestnut Street, Newton Upper Falls 64, Massachusetts. *A Subsidiary of E. W. Bliss Co.*

*Facts on chart, itemized by The Gamewell Company, were taken from an article entitled "The Easiest Help Your Competitor Ever Got," in the May-June, 1959, issue of MODERN PLANT AND OPERATION MAINTENANCE. Reprints of this article may be obtained by filling out the coupon.

BLISS
Gamewell
FIRST...WHEN SECONDS COUNT

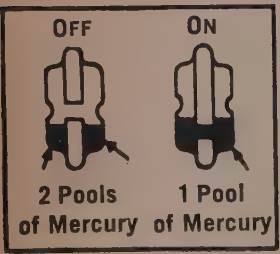
THE GAMEWELL COMPANY
1315 Chestnut Street
Newton Upper Falls 64, Mass.
A Subsidiary of E. W. Bliss Co.

☐ Have a Gamewell Fire Protection Engineer call.
☐ Send me a Gamewell Fire Alarm System Planning Guide
☐ Send a reprint of article "The Easiest Help Your Competitor Ever Got."

Name
Title
Firm
City . . . . *Zone* . . . . *State* . . . .

Switch to

General Electric Silent and smoothly as a



COMPLETELY SILENT—ONLY ONE MOVING PART!

The round button in this G-E Silent Mercury Switch turns without a whisper when you flip the handle. And it's the **only** moving part.

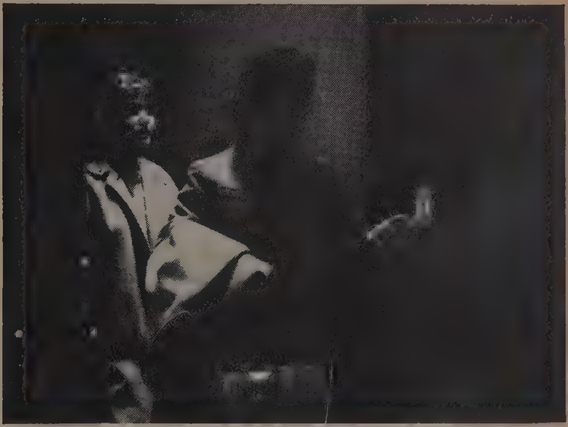
There's nothing to **snap, click** or **pop**—just two pools of mercury flowing together or apart, inside the button, for ON and OFF.

So-called "quiet" type switches with mechanical contacts can never equal this soft, liquid action—in complete silence—in comfortable feel—in freedom from wear and breakdown.

Silence!

Mercury Switches operate as silently thermometer: last for years and years

LAST YEARS LONGER THAN SNAP-TYPE OR "QUIET"-TYPE SWITCHES G-E Silent Mercury Switches have been turned ON—OFF, ON—OFF more than 1,000,000 times without failure! Lab tests indicate their average life is 500,000 cycles — some 14 times the required life of ordinary switches.



No groping! You can find these switches in the dark.

For bathrooms, basements, storerooms, halls and other often-dark spots, G-E Silent Mercury Switches are available with lighted handles. Built-in lamps "locate" these switches; also show when circuits are OFF.

Regular (non-lighted) switches available with brown or ivory handles—single-pole, double pole, 3-way or 4-way. Lighted-handle switches available with ivory handle—single pole or 3-way. Listed by Underwriters' Laboratories, Inc., meet Federal and REA specifications.

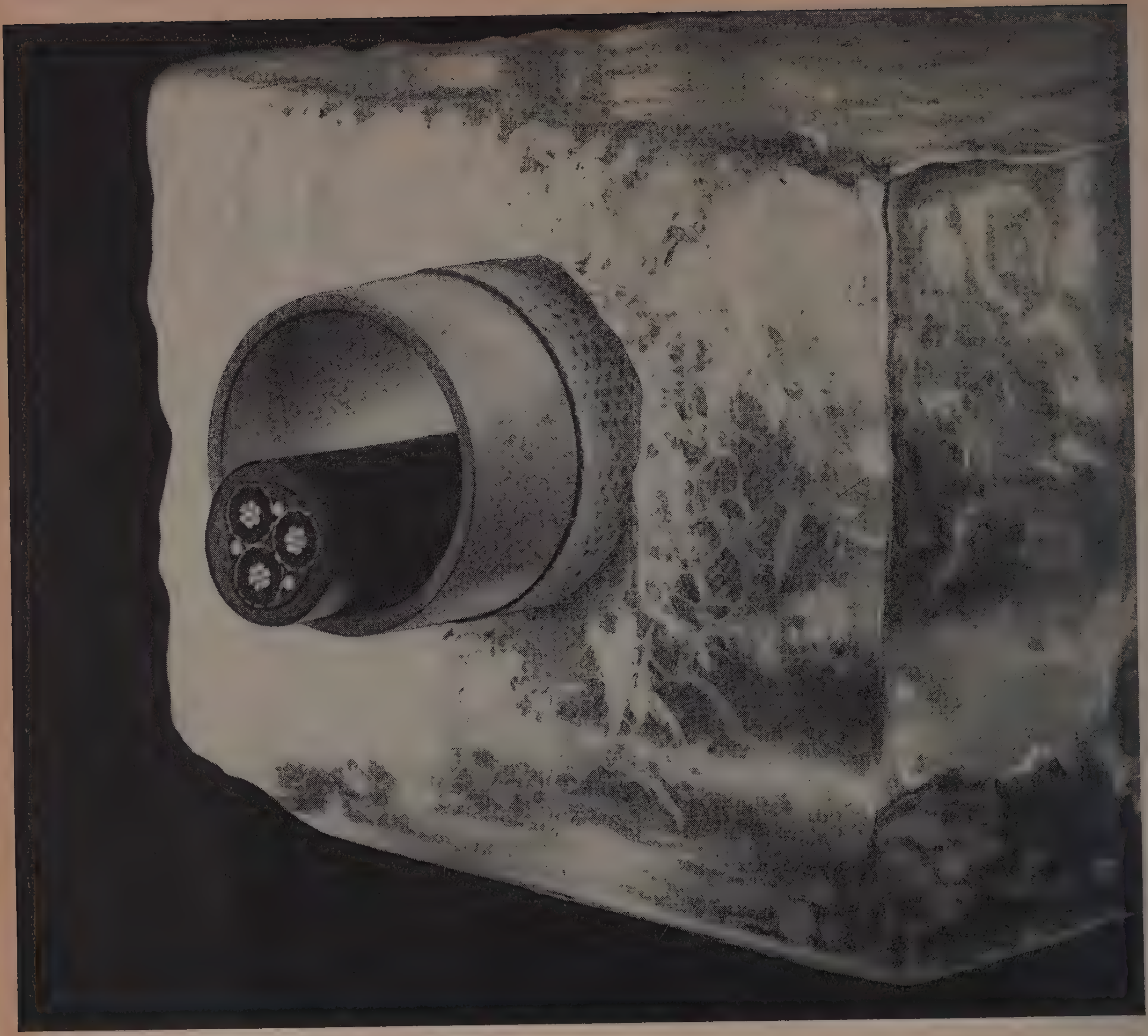
TOP QUALITY—REASONABLE IN COST These silent General Electric switches are Specification Grade: can be used to full 10A-125V T- and 15A-120V AC- ratings for tungsten filament and fluorescent lamp loads. They cost little or no more than other high-quality switches, usually cost less per year of service.

SWITCH TO SILENCE! Suggest G-E Silent Mercury Switches for homes, motels, stores, offices, industry—anywhere complete silence, long life, or luxury-smooth action in a switch will be appreciated.

General Electric Company, Wiring Device Dept., Providence 7, Rhode Island.

Progress Is Our Most Important Product

GENERAL ELECTRIC

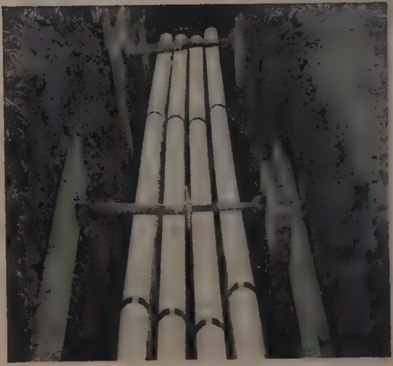


Cooler cables at lowest costs with Transite Ducts!

Do you know that electrical system losses amount to more than four hundred million dollars annually? Research shows that these losses can be drastically reduced by improving the dissipation of heat from conductors under load. The most efficient and economical way to accomplish this is with inorganic Transite® Ducts.

Tests prove that asbestos-cement Transite Ducts can actually have as much as 110.6% greater heat-carrying ability than organic ducts. This means that when a conductor is supplying a given load, its temperature will be substantially lower in Transite. These cooler cables result in lower electrical resistance with correspondingly lower I^2R losses. At a $20/KW cost, this can save you as much as $8.20 per thousand feet a year. Lower operating temperatures mean longer cable life and more reliable service, too!

Because of their 10′ lengths and speedy coupling method, Transite Ducts can be installed at the lowest cost. Get the full story by writing Johns-Manville, Box 14, ECM-2, New York 16, N. Y. In Canda: Port Credit, Ontario.

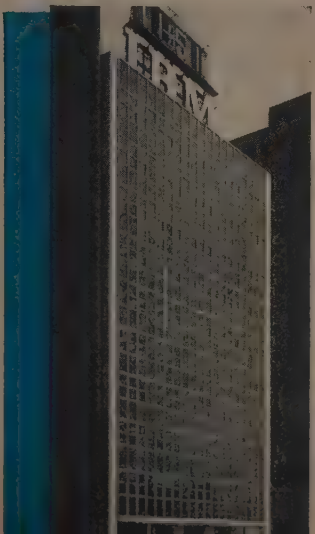


JOHNS-MANVILLE

New 55° LIGHT SHIELDING LOUVERS
MAKE THE DIFFERENCE
in future lighting standards—available today!

IBM DATACENTER — CHICAGO, ILLINOIS

INSTALLED AND MAINTAINED BY STEEL CITY FLUORESCENT, CHICAGO, ILLINOIS



American's New 55° deep-cell styrene louver diffusers installed in IBM DATACENTER, CHICAGO, ILLINOIS — The deep-cell ½″ high louvers provide better shielding from the light source, with optimum efficiency — higher lighting levels with exceptional unexcelled glare-free low brightness, comfort and appearance. The 55° angle shielding of uniform light distribution is the proven louver for today's and tomorrow's recommended higher lighting levels.

Louvers available in translucent white and a wide range of colors for use in individual fixtures, modular units and large areas of illumination. They may be cut, grooved or sized to meet the Architect, Designer or Fixture Manufacturers' most exacting requirements. Cell size 25/64″ x 25/64″ x ½″ high.

Exclusive process by American Louver Company
U.S.A. Patent No. 2,566,817
Canadian Patent No. 484,346
U.S.A. Patent No. 2,607,455
Canadian Patent No. 497,047

Engineers are available in your area to help with your lighting problems — or write American Louver Company direct: Consultants to the lighting industry since 1939.

american louver company
5308 NORTH ELSTON AVENUE • CHICAGO 30, ILL.

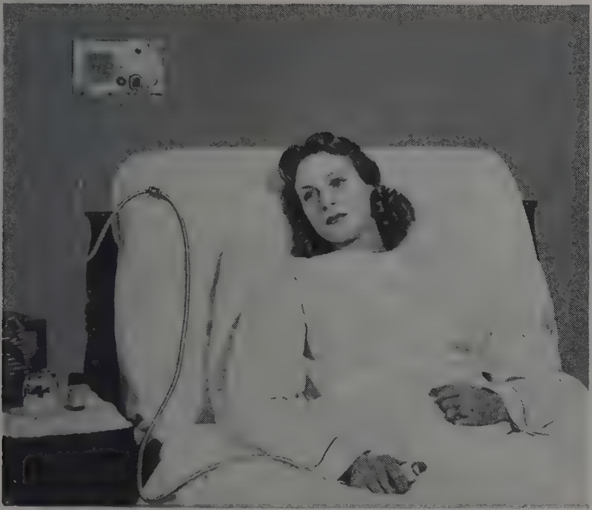
MAKE THIS STEELDUCT TEST...

BEFORE YOU BUY RIGID GALVANIZED CONDUIT

Hand run a coupling on Steelduct uniform galvanized threads. The coupling will run free but not loose. Steelduct galvanized threads are sharp and clean because the Steelduct galvanizing process produces a measured uniform coating, free of any excess deposits of zinc. Uniform galvanized threads by STEELDUCT cut installation costs by eliminating rusty threads and assuring free running couplings.

THE STEELDUCT COMPANY
REPUBLIC STEEL BUILDING YOUNGSTOWN, OHIO

Thousands of Firms Have Profited from **AUTH SIGNALING EQUIPMENT!**...Has Yours?



FOR HOSPITALS: *Nurses' Call, Doctors' In-and-Out, and Paging Systems; also, Clock, Fire Alarm Systems, and Ground Detectors.*

FOR SCHOOLS: *Centralized Clock and Program Bell Systems; Fire Alarm Systems; and Products for Vocational Training.*

FOR APARTMENTS: *Apartment House Telephone and Bell Systems: also, U.S. Approved Mail Boxes and Non-Electric Door Chimes.*

FOR INDUSTRY: *Supervisory Annunciators, Audible Signals, and Push Buttons; also, Fire Alarm and Clock Systems.*

The name AUTH on electrical signaling, time, and communication equipment conveys different meanings, all of which can be summed up in one word —profit!

To owners—and their representatives, the architectural and engineering firms —Auth stands for capable assistance in planning requirements, excellent product performance, and minimum upkeep.

To distributors, Auth means easily-consumated orders at the right price—without rejections, delays, or excess paperwork.

To installing contractors, Auth represents well-made, dependable equipment specifically designed to simplify installation. They hook it up and walk away!

Everyone profits when fine equipment —as made by Auth—is specified, purchased, and installed.

If your firm hasn't had experience with Auth signaling equipment, why not start now? An Auth representative will be delighted to be of service. Please call him on your next job. No obligation, of course.

Auth Electric Company, Inc.
LONG ISLAND CITY 1, NEW YORK

SPECIALISTS IN ELECTRICAL SIGNALING AND COMMUNICATION SYSTEMS AND EQUIPMENT

CONTROL

Now! Make any pushbutton station you want with new, completely versatile Cutler-Hammer oiltight pushbuttons

Choose from a complete line of operators,
get greater circuit flexibility than with any other make

To meet today's need for a broad range of oiltight pushbuttons, Cutler-Hammer gives you a new versatile line.

You can get these rugged proved pushbuttons in one hole or base mounting, six bright colors. More than thirty different circuit arrangements are available plus hundreds of varieties of stations in standard arrangements of up to 25 elements. And you can get up to 8 circuits on one pushbutton. The flexible oil resistant diaphragm behind the button is designed to stay soft and pliable permanently.

With Cutler-Hammer pushbuttons you can get more control in less space, too, because they use 40% less behind the panel space than the next smallest unit.

Get all the facts by sending for the colorful brochure, "MASTER DESIGN" which tells you all about the Cutler-Hammer line. Ask for Pub. LO-104.

What's new at Cutler-Hammer? You can see the newness in the products coming from Cutler-Hammer, like the new smaller pushbuttons; in the new manufacturing facilities; in the new engineering ideas. All to give you better service today and in the future. Contact the nearest Cutler-Hammer sales office or your Cutler-Hammer distributor.

WHAT'S NEW? ASK...

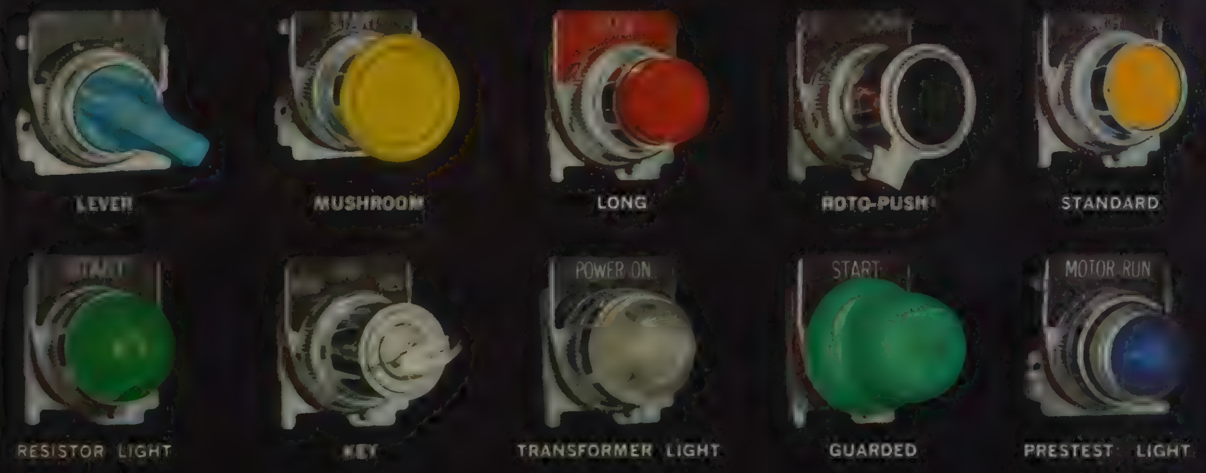
CUTLER-HAMMER

CONTROL

Cutler-Hammer Inc., Milwaukee, Wisconsin • Division: Airborne Instruments Laboratory • Subsidiary: Cutler-Hammer International, C. A. • Associates: Canadian Cutler-Hammer, Ltd.; Cutler-Hammer Mexicana, S. A.

NEW ILLUMINATED PUSHBUTTON. Newest addition to the versatile line.

YOU CAN GET ALL THESE TYPES OF CONTROL UNITS



McGILL®

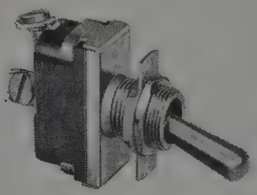
Levolier®

electrical specialties are

BUILT BETTER to LAST LONGER

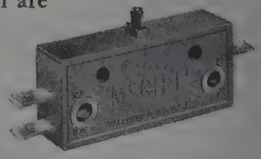
UNCONDITIONALLY GUARANTEED

The McGill No. 41 Levolier switch is unconditionally guaranteed against failure in lighting circuits. 6 amp. "T" 125 V. 3 amp. 250 V.

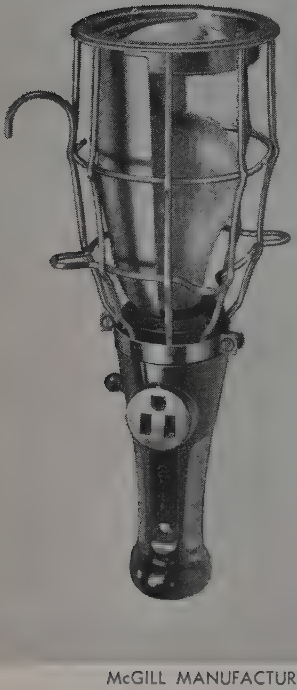


McGILL LEVOLIER SWITCHES

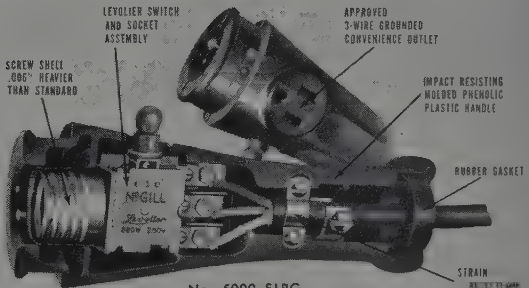
The same high standards of material selection and workmanship that make it possible for McGill to guarantee the No. 41 Levolier switch are applied to all McGill products. Levolier universal lever, toggle, momentary contact and special use switches from 3 to 20 amps have set performance records in a wide variety of uses. All are Underwriters' Laboratories, Inc. inspected.



McGILL PORTABLE LAMP GUARDS



McGill Lampguards are designed and built to withstand rugged industrial service. Top quality and careful workmanship assures a safe dependable light; where you want it, when you need it. Over 100 different types available including Grounded, Vapor Proof, and a variety of types of cages, handles and sizes.


LEVOLIER SWITCH AND SOCKET ASSEMBLY
APPROVED 3-WIRE GROUNDED CONVENIENCE OUTLET
SCREW SHELL .006" HEAVIER THAN STANDARD
IMPACT RESISTING MOLDED PHENOLIC PLASTIC HANDLE
RUBBER GASKET
STRAIN

No. 5000 SLRG

WRITE FOR McGILL ELECTRICAL SPECIALTIES CATALOG NO. 84

engineered electrical products

McGILL®

precision needle roller bearings

McGILL MANUFACTURING COMPANY, INC., ELECTRICAL DIV., 450 N. CAMPBELL ST., VALPARAISO, INDIANA

THERE IS A DIFFERENCE IN I·T·E UNI-PAK LOADCENTER INTERIORS

NO MONKEY WRENCH BOLTS!

I-T-E INTERIORS HANG LIKE PICTURES

No damaged interiors when you install I-T-E Uni-Pak Loadcenters!

First, you fit the 14¼″ Uni-Pak box snugly between studs and secure it. The rest is easy. You merely "hang" the interior as you would a picture. Neat and fast! Next, add trim . . . and job's done!

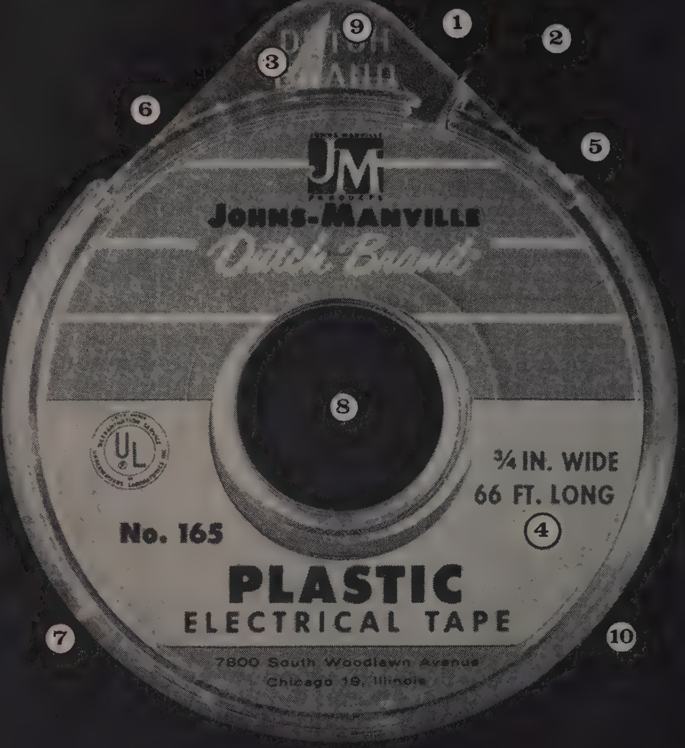
I-T-E puts box, interior, and trim in separate packages. You install separately. Result? Maximum flexibility! Every Uni-Pak Loadcenter box will hold a variety of fusible *or* circuit breaker interiors. Example: the 24-inch box will take any one of 58 choices according to your needs.

Get all of the facts. Write I-T-E Circuit Breaker Company, Walker Division, 125 Bennett Street, N.W., Atlanta 9, Georgia. Ask for Bulletin D-64.

The HEART of HOUSEPOWER ⚡ Nerve-Center of The Medallion Home

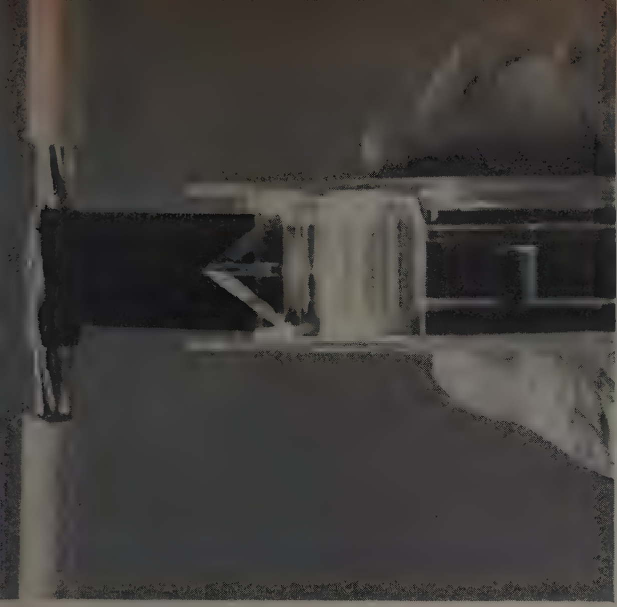
I-T-E CIRCUIT BREAKER COMPANY
WALKER DIVISION

New from Johns-Manville



1. *"Tape-and-tear" in single action!* **2.** *Special "grip-strip" for faster starting!* **3.** *Permanently shielded cutter!* **4.** *Full 66′ of finest plastic tape made!* **5.** *Preloaded . . . ready to go!* **6.** *No moving parts to snag hands, clothes!* **7.** *Protects tape against dirt, grease!* **8.** *Big center hole for easy handling!* **9.** *Can't dull or clog!* **10.** SAME PRICE AS BEFORE!

NEW!
Plastic tape dispenser for faster, easier splices!



Here's how it works: Wrap splice as usual.

B. *Puncture tape.*

Pull . . . tape tears straight without stretching.

D. *New end stands up . . . ready for next splice.*

JOHNS-MANVILLE'S ALL-NEW DISPENSER takes all the lost motion and lost tempers out of splicing with plastic tape! It's far safer, too, because the cutter is permanently shielded . . . can't snag hands or clothes.

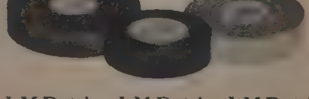
From beginning to end, J-M *Dutch* Plastic Tape in its all-new dispenser saves time and trouble. It has fast, one-motion "tape-and-tear" action. "Grip-strip" pops up...ready for the next splice instantly. You get a full 66′ of *Dutch* Plastic Tape—top choice of electricians everywhere.

And, wonder of wonders, you get all this at NO increase in price!

Ask your Johns-Manville *Dutch Brand*® distributor for all the facts. Or write Johns-Manville, Box 14, New York 16. In Canada: Port Credit, Ont. Cable: Johnmanvil.

JOHNS-MANVILLE JM

OTHER FINE ELECTRICAL TAPES FROM J-M . . .

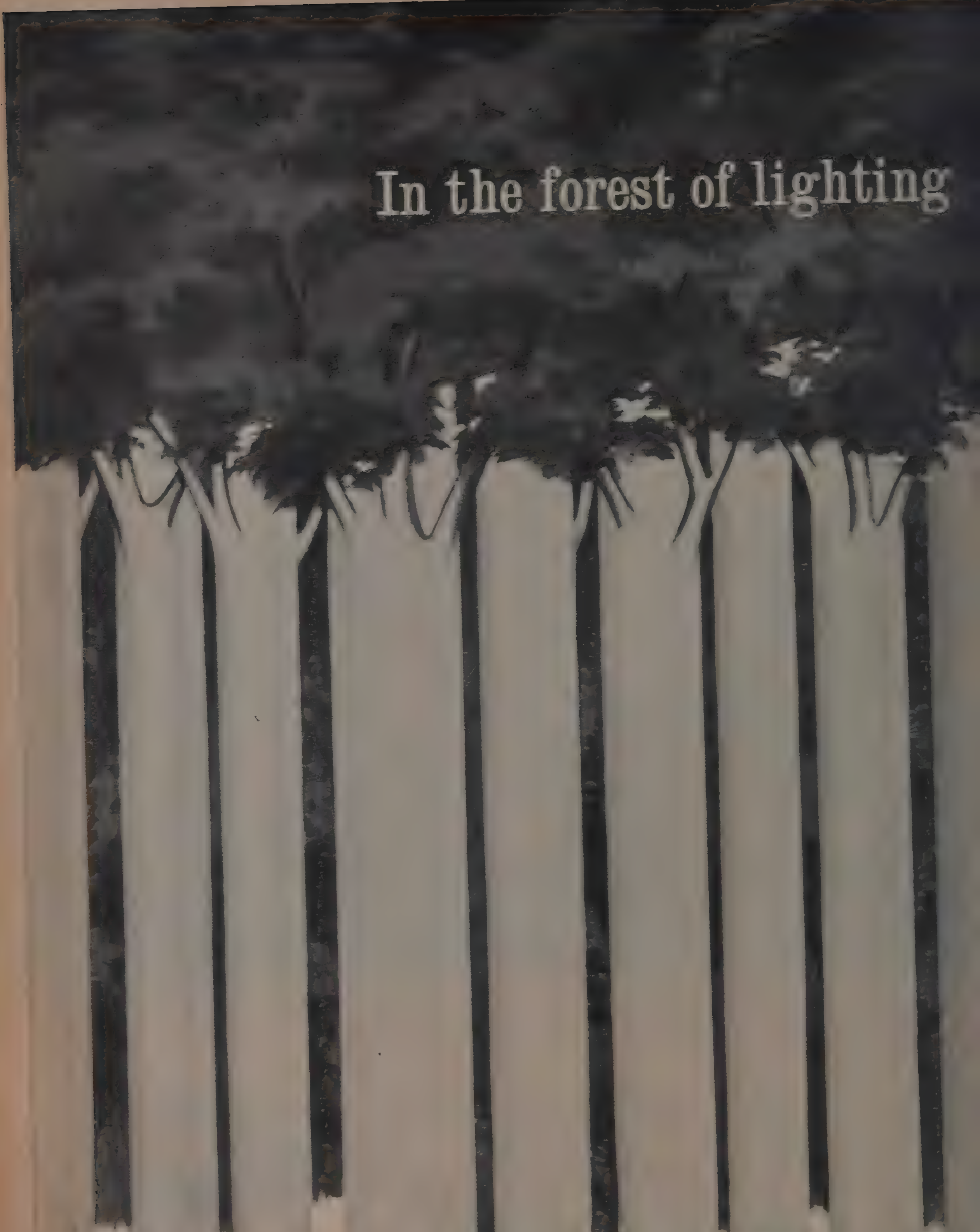


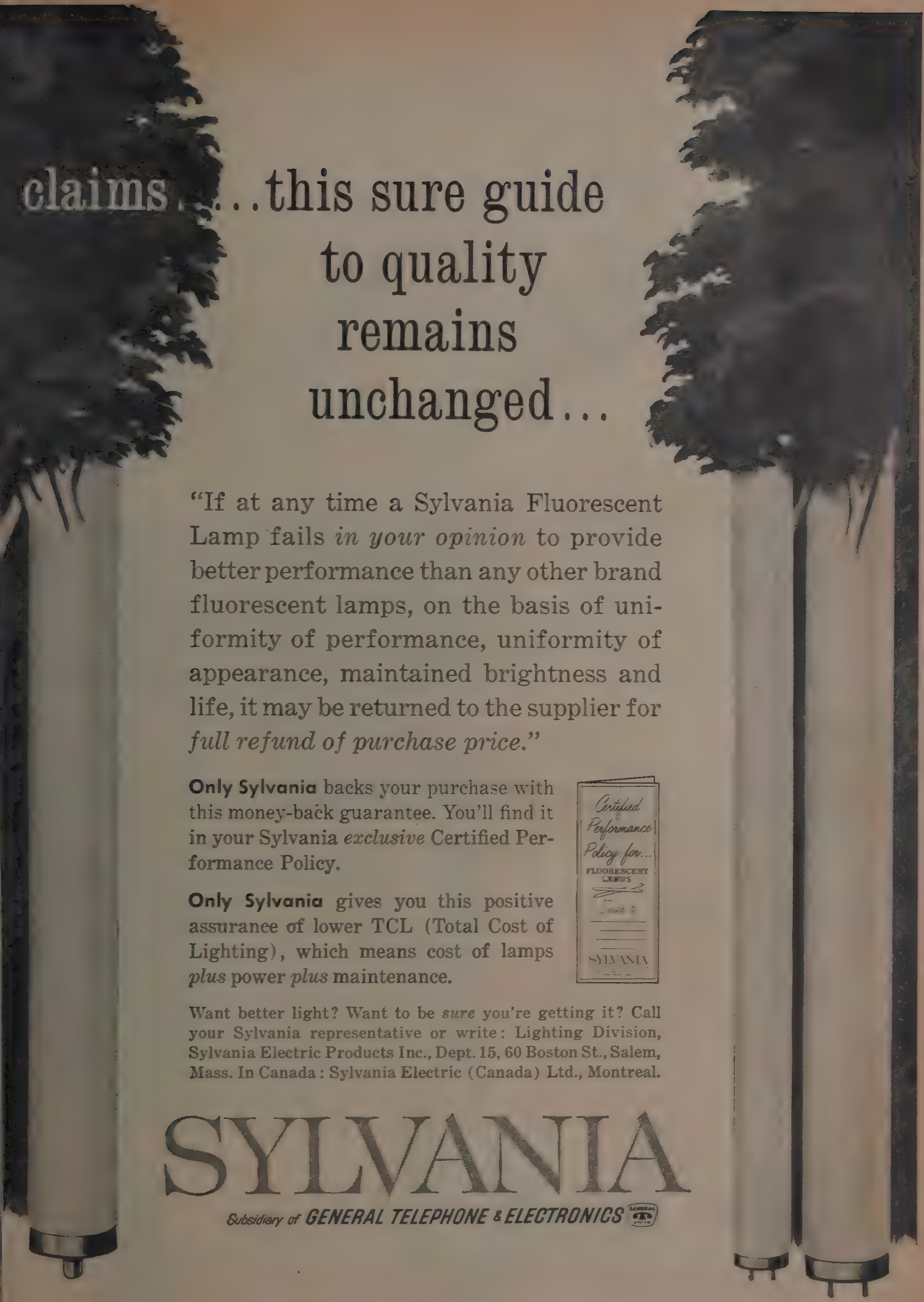
J-M Dutch *Friction Tape*

J-M Dutch *Special Purpose Tapes*

J-M Dutch *Rubber Tape*

Remember—Johns-Manville, and ONLY Johns-Manville, makes every major type of electrical and industrial tape!


In the forest of lighting



claims ...this sure guide to quality remains unchanged...

"If at any time a Sylvania Fluorescent Lamp fails *in your opinion* to provide better performance than any other brand fluorescent lamps, on the basis of uniformity of performance, uniformity of appearance, maintained brightness and life, it may be returned to the supplier for *full refund of purchase price.*"

Only Sylvania backs your purchase with this money-back guarantee. You'll find it in your Sylvania *exclusive* Certified Performance Policy.

Only Sylvania gives you this positive assurance of lower TCL (Total Cost of Lighting), which means cost of lamps *plus* power *plus* maintenance.

Want better light? Want to be *sure* you're getting it? Call your Sylvania representative or write: Lighting Division, Sylvania Electric Products Inc., Dept. 15, 60 Boston St., Salem, Mass. In Canada: Sylvania Electric (Canada) Ltd., Montreal.

SYLVANIA

Subsidiary of **GENERAL TELEPHONE & ELECTRONICS**

Three new electrical applications use HYPALON® for color coding, resistance to weather, ozone, corona

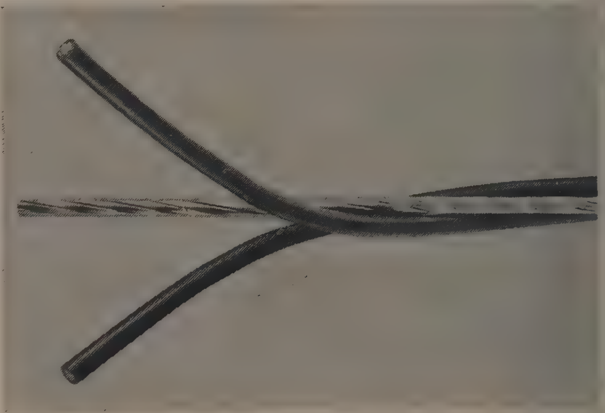
High-Performance Du Pont Synthetic Rubber Proves Its Versatility as Jacketing and Insulation for Wire and Cable.

Color-coded triplex with HYPALON jacket *and* insulation permits accurate phase identification. HYPALON jacket will not discolor . . . resists flame, weathering, abrasion, hot and cold flow.

Aerial cable for industrial locations is covered with HYPALON for resistance to corrosive fumes, air-borne chemicals, ozone and corona discharge. HYPALON jacketing is *practically immune* to ozone, will not support combustion, resists exposure to oil and grease.

Corona-resistant connectors molded of HYPALON are rated at 7500 volts . . . permit the use of higher voltage portable machinery in plants and mines. HYPALON is virtually corona-*proof* compared to other elastomers . . . offers good resistance to abrasion, oxidizing chemicals.

These latest electrical applications for HYPALON synthetic rubber illustrate the versatility obtainable with this new wire and cable covering material. HYPALON's outstanding resistance to weather, aging, ozone, corona, flame, abrasion, oil and chemicals (proven in 10 years of wide industrial use) means long life and economical performance to meet the most demanding service needs. That's why HYPALON is specified for high-performance automotive ignition wire . . . for appliance cord . . . tree wire . . . service drop wire . . . submarine cable . . . building wire . . . to list just a few of its current applications. Learn more about Du Pont HYPALON and how it can improve performance of the cable and electrical accessories *you* use. For information, write E. I. du Pont de Nemours & Company (Inc.), Elastomer Chemicals Dept. ECM-2, Wilmington 98, Del.



DU PONT
REG. U. S. PAT. OFF.

HYPALON
SYNTHETIC RUBBER

Better Things for Better Living . . . *through Chemistry*

WHEN LIGHTS GO OUT . . . LIGHTGUARD GOES ON INSTANTLY AND AUTOMATICALLY

Most popular model. Completely automatic. Features Exide rechargeable battery and fast acting 2-rate charger. Available for one, two or three lamps.

ALL EMERGENCY LIGHTING UNITS AREN'T ALIKE!!

Exide Lightguard® uses sealed beam lamps, just like your car. It never loses its brightness, even in a corrosive atmosphere. Powered by a special long-life Exide battery of same type as used by electric utility companies for power control. Gives you extra hours of light when you need it . . . extra years of economical life. Built-in charger automatically brings battery back to capacity after each use and keeps it there. No time clock needed. Exide Lightguard is easy to install. Plug into regular a-c outlet. When power fails and regular lights go out, Lightguard goes on instantly and automatically. See Exide Lightguard at your nearby electrical distributor's. Or write for literature. Exide Industrial Marketing Division, The Electric Storage Battery Company, Philadelphia 20, Pa.

Dry cell model
◀ Most economical to buy. Same lamp brilliance as storage battery model. Uses standard dry cells, available everywhere.

To cover larger areas ▶
New Model E. Three times more battery capacity. New fast-acting 2-rate charger can handle up to five brilliant lamps.

Exide®
INDUSTRIAL MARKETING DIVISION
The Electric Storage Battery Company (ESB)

JOB-PROFIT TOOLING IDEAS

FROM GREENLEE

now even more help to speed your jobs, cut costs with the most complete and versatile line of hydraulic conduit benders on the market

WHATEVER THE

...THERE'S A

Save valuable time and materials, *contro* *costs* by bending conduit right on the job with a Greenlee Bender. Wide choice of models for every bending need . . . ½″ through 6″ sizes steel and aluminum conduit and pipe. Make one-shot 90° bends . . . offsets . . . concentric bends . . . large sweeps . . . thin-wall bends. With the addition of the new No. 777 segment bender (left) for 1¼″ thru 4″ conduit, Greenlee offers you the widest selection by far, *all from a single source*

No. 777 . . . lightest, most powerful 4″ Segment Bender. Only 65 lb (exclusive of shoes) Makes segment bends 1¼″ thru 4″ conduit. Perfect for tight kicks—bends 14″ from end of 4″ pipe.

One-shot 90° bending with Greenlee No. 777 Bender. An *exclusive* advantage. Adapts to one-shot 90° bending of ½″ thru 2″ conduit simply with addition of a few optional parts.

Thin-wall bending with Gre lee No. 777 bender. An *exclu* advantage. With quickly mou attachment the No. 777 bende economically converted to b thin-wall conduit ¾″ thru 2″.

For ½″ thru 4″ Conduit . . . Greenlee No. 884 bender makes fast 90° bends in one shot . . . steel and aluminum conduit. Lightweight, one-man operated with hand or power pump.

Offsets in seconds with Greenlee No. 888 Multipurpose Bender . . . A fast, extra-versatile bender for quickly making offsets in ½″ thru 2″ conduit . . . with one setting, one shot. Offsets always in perfect alignment—no doglegs! Also makes 90° bends, close to the end of conduit. Fast operation with hand or power pump.

BENDING JOB GREENLEE TO DO IT!

For ½″ thru 3″ conduit . . . Greenlee No. 883 bender makes up to 90° bends with one shot in steel and aluminum conduit. Lightweight, portable. One-man operated with hand or power pump. Attachments available for thin-wall bending.

For ½″ thru 2″ conduit . . . Greenlee No. 880-M2 lightweight bender makes up to 90° bends with one shot in steel and aluminum conduit. Fast one-man operation with hand or power pump. Attachments available for thin-wall bending.

For 1¼″ thru 6″ conduit . . . Greenlee No. 785-BE power bender is equipped with 90° bending shoes for fast, easy operation. Can be used for one-shot or segment bending. Regularly equipped to bend sizes to 5″, with 6″ attachment optional.

GREENLEE TOOL CO., 1953 Columbia Avenue, Rockford, Illinois

Ask your distributor for a demonstration, or write for literature.

TOOLS FOR CRAFTSMEN
GREENLEE ®

JOB PROFIT TOOLING

. . . cost control for contractors

ON E.C.I. JOB . . .

WESTINGHOUSE EQUIPMENT HELPS CONTRACTOR CUT INSTALLATION COSTS

1.

Perfect coordination of all Westinghouse equipment enabled Gabrio Electric Co., St. Petersburg, to beat its own installation estimates for electrical services in the new Florida plant of Electronic Communications, Inc. "In one instance alone, we saved up to 11% on labor, installing Westinghouse dry-type transformers which are smaller and lighter than the usual equipment," reports John Gabrio. "Service scheduling was excellent. Deliveries were well planned—everything fell exactly into place. All equipment was easy to tie together."

Project-wide savings for the installing contractor are based on Westinghouse engineering aimed at making equipment as fast and easy to install as possible. Extensive prewiring serves the same purpose. What's more, this ultimate in installation efficiency is achieved in addition to high-as-possible performance engineering objectives.

Management at Electronic Communications declared that "specifications were written around Westinghouse equipment because the high quality of Westinghouse products was desired." On these and the following two pages, read how Westinghouse helps another contractor help his customer enter the competitive '60s Powered-Up for quality. *You can be sure . . . if it's Westinghouse.*

J-94160-1

2.

Westinghouse

J-941

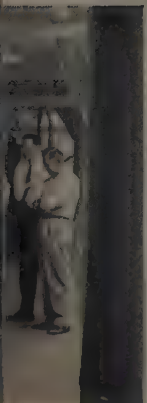
1. Attractive, modern buildings house Electronic Communications, Inc., of St. Petersburg, Florida. Company specializes in airborne electronic equipment and is fully equipped to perform advanced engineering studies in its field.

2. M. A. Lochridge, Westinghouse, discusses 1200-ampere type DB-50 air circuit breakers used as main and tie breakers in this 1500-kva double-ended power center switchboard with John Feltman, Manufacturing Manager, E.C.I.; and J. E. Gabrio, Gabrio Electric. Entire unit was easy to install. Balcony mounting permitted area under platform to be utilized for other purposes.

3. Side view of 1500-kva double-ended power center showing one of two 750-kva Inerteen®-filled transformers throat-connected to switchboard at right and 15-kv primary type LCB fused switch at left. Inerteen unit requires no vault. Components matched perfectly, speeding installation.

4. Electronic's finished products receive many checks at test boards like these.

5. John Gabrio; J. R. Miller, Westinghouse Construction Engineer; and George Low, Plant Maintenance Supt., discuss how easily lightweight, 75-kva Westinghouse DT-3 dry-type transformer mounts overhead, saving installation time. Westinghouse panelboard, breakers and disconnect switches conveniently mounted at right provide local control of services in this area, including lighting and air conditioning.



3.

4.

5.

6. Eight runs of Westinghouse 225-amp, aluminum plug-in bus duct carry full power throughout entire plant. Plug-in circuit breakers, as shown top left, provide a fast, convenient means of power take-off . . . units can be moved or added to accommodate load changes. Breakers protect both circuits and power equipment. Bill Barlow, Wesco Salesman, at right, explains safety door interlock feature of the plug-in breaker unit to John Gabrio and George Low.

7. John Gabrio and Bill Barlow view two small Westinghouse EP dry-type transformers. Five-kva unit on left serves a lighting panel. The 3-kva unit in the center furnishes 120/240 volts for fence lighting remotely controlled by Life-Line® contactor at right.

8. Specialized test area, free of RF interference, behind protective copper screening; beyond, a general assembly area.

9. George Low, with M. A. Lochridge, operates a 3-pole, F frame breaker in a Westinghouse convertible distribution panelboard. F and J frame breakers protect lighting and power feeders fed from this easy-to-wire panelboard.

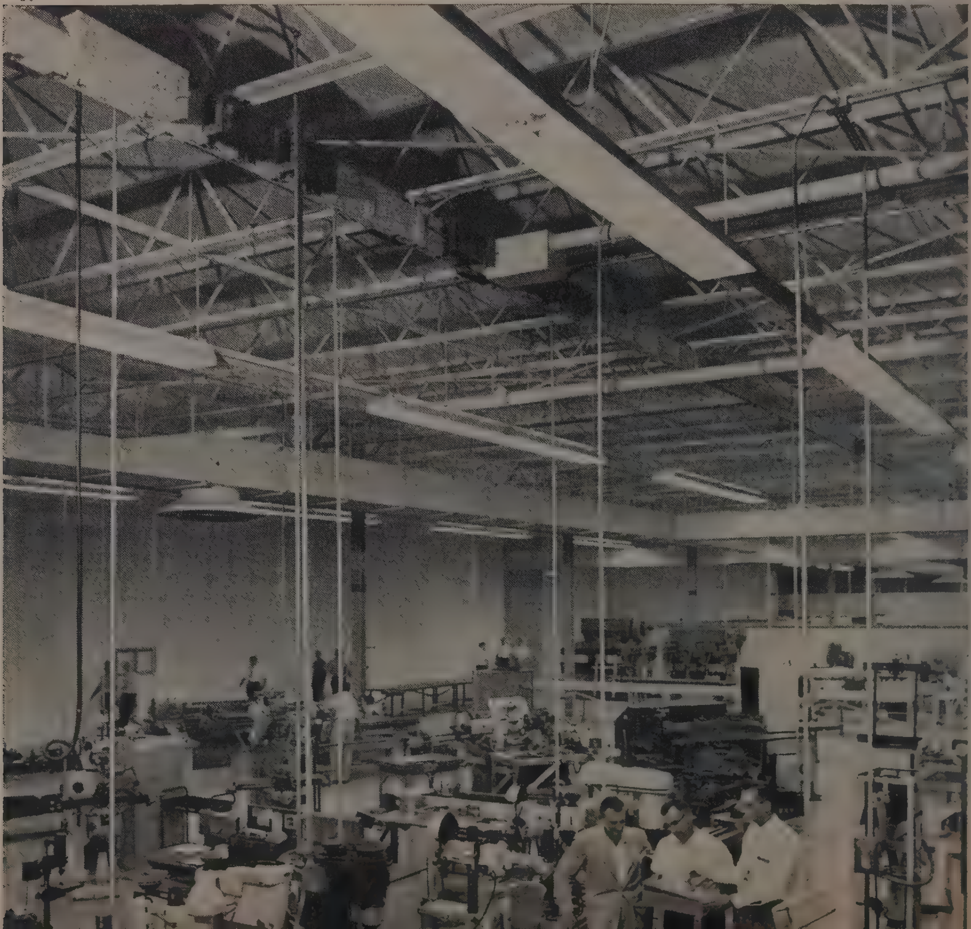
Ample gutter space, neutral bar extension, prephased identification, back pan adjustment and self-locating trim clamps help Westinghouse panelboards go in fast.

10. Discussing job progress are: F. Godsey, President of E.C.I.; George H. Bail, Bail, Horton and Associates; L. J. Hennessy of A. P. Hennessy & Sons, General Contractors; M. A. Lochridge, Westinghouse Sales Engineer; John E. Gabrio of Gabrio Electric Co.; Ralph E. Bail of Bail, Horton; L. W. Willey, V.P. Operations, E.C.I.

Owner: Electronic Communications, Inc., St. Petersburg, Fla.
Architects and Engineers: Bail, Horton and Associates, Ft. Myers, Fla.
General Contractor: A. P. Hennessy & Sons, St. Petersburg, Fla.
Electrical Contractor: Gabrio Electric Co., St. Petersburg, Fla.
Westinghouse Distributor: Wesco, Tampa, Fla.

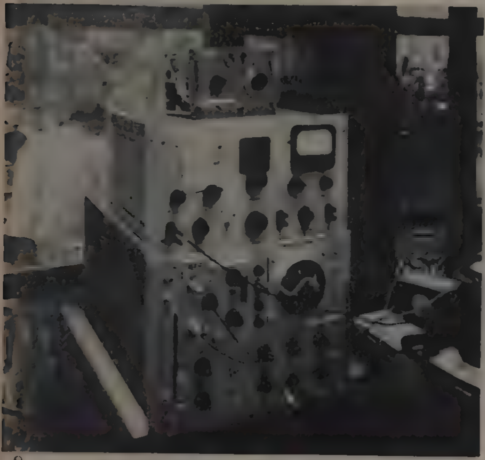
6.

J-94160-3



11.

7.



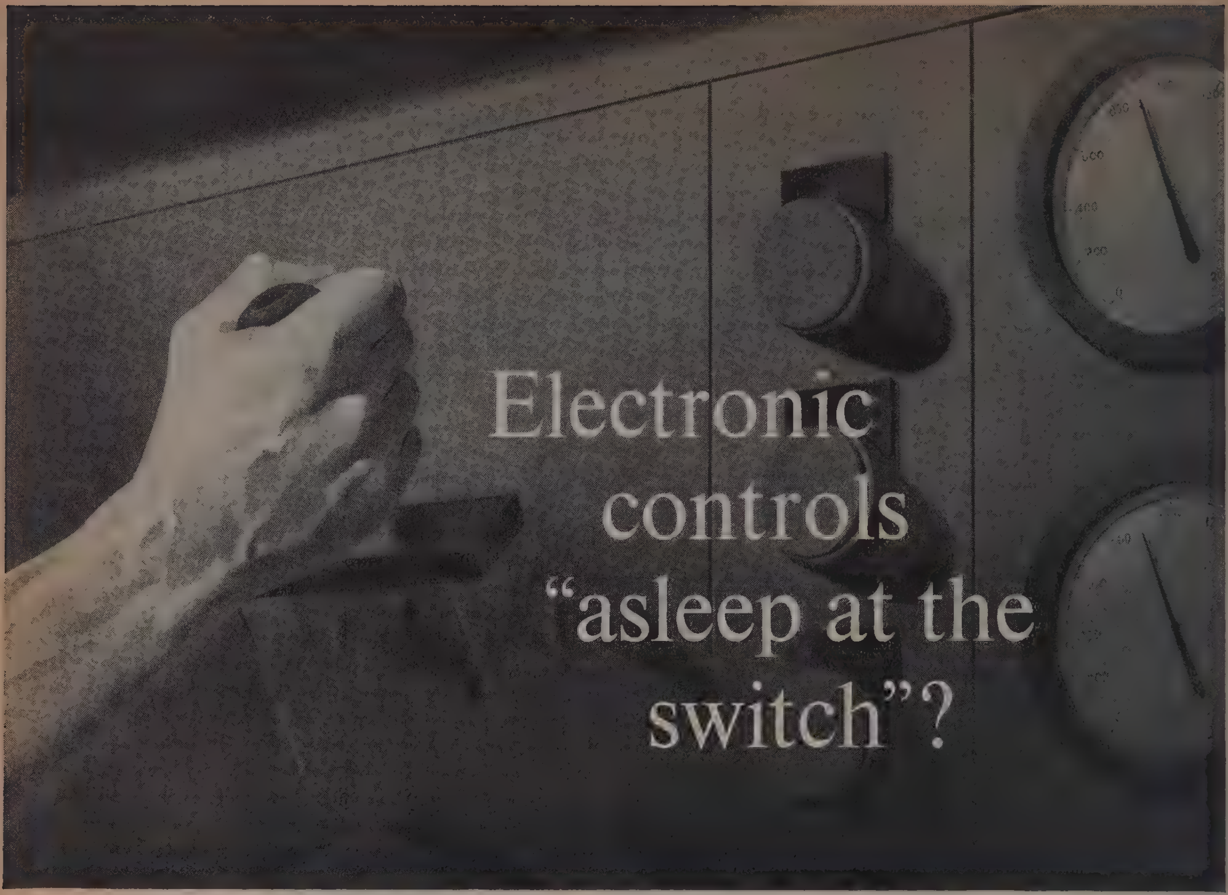
8.

9.

10.

J-94160-4

Westinghouse



Replace with Sylvania Thyratrons

Control circuits demand instant "wide-awake" switching response and stable performance over extended periods of operation. They need just the kind of operating dependability you get with Sylvania Thyratrons.

Take, for example, the case of Sylvania GB-5727, Gold Brand premium version of the popular 2D21, miniature tetrode thyratron. Sylvania went to the heart of the 2D21, analyzed its life performance, re-evaluated its design, and "beefed up" its structure to come up with GB-5727. Sylvania GB-5727 is subjected to rigid scrutiny throughout manufacture, given "white glove" treatment to keep its internal structure free of contaminants that deteriorate performance. It undergoes tests, such as an 850g shock, more severe than it will meet in actual operation. The result is a tube that can be relied upon for stable performance under severe conditions over a long. useful life.

For fast response, call your "wide-awake" Sylvania Industrial Tube Distributor. His prompt, off-the-shelf delivery and thorough follow-up can save you valuable time and dollars. Have his phone number handy. Ask him for the free "Gold Brand Tubes" booklet, or write Electronic Tubes Division, Sylvania Electric Products Inc., Dept. 152 1100 Main Street, Buffalo 9, N. Y.

SYLVANIA

SUBSIDIARY OF

GENERAL TELEPHONE & ELECTRONICS

GENERAL SYSTEM

60TH YEAR • FEBRUARY, 1961

ELECTRICAL
CONSTRUCTION
AND MAINTENANCE

Uninterrupted Power Supply

In nuclear reactor installations, power requirements are so exacting that three or more independent sources are provided to assure absolutely safe continuity of supply. Loss of power for only a few moments during high level operation can result in serious damage to the reactor core. The immense heat output of a nuclear reaction cannot be stopped quickly, but must be allowed to decay under full control. Pumps, ventilators, auxiliaries and controls, consequently, must have uninterrupted power supply.

Typical installations are supplied from two utility primary lines with fast-acting automatic transfer switches connecting equipment to the standby source if the main supply fails. For control, auxiliaries and other critical circuits, an ingenious emergency engine-generator set is provided, sometimes in duplicate, which differs from conventional standby facilities in that the generator is operated continuously by an electric motor and provides power to the critical circuits under both normal and emergency conditions. The change-over from electric motor to diesel engine power is accomplished automatically in the drive, which includes a heavy fly-wheel to furnish energy for the seconds it takes to start the engine and engage the clutch.

Lighting in the reactor building is also considered as critical. Circuits are supplied from a storage battery normally floating on a dc bus powered by a static rectifier. Where extended power outage must be provided for, the battery may be backed up by a conventional engine-generator set.

An important by-product of the uninterrupted power supply is the effective electrical isolation of the critical circuits from incoming line disturbances. The massive mechanical coupling of the motor-generator set is inherently immune to line voltage fluctuations or transients which might disturb the precise operations of sensitive instruments, controls and other apparatus.

Applications of uninterrupted power supply facilities are appearing also in computer centers, missile bases, automated processing plants and communication centers where even momentary interruptions cannot be tolerated, or where a systematic sequence of shut-down operations must be run through to avoid product spoilage or equipment damage.

Considering the enormous investment involved in some of our modern technical facilities, provisions for absolutely reliable power supply are prudent insurance. Where there is total reliance on continuous electric power, such provisions are vitally essential.

Wm. T. Stuart

NOW YOUR SYMBOLS

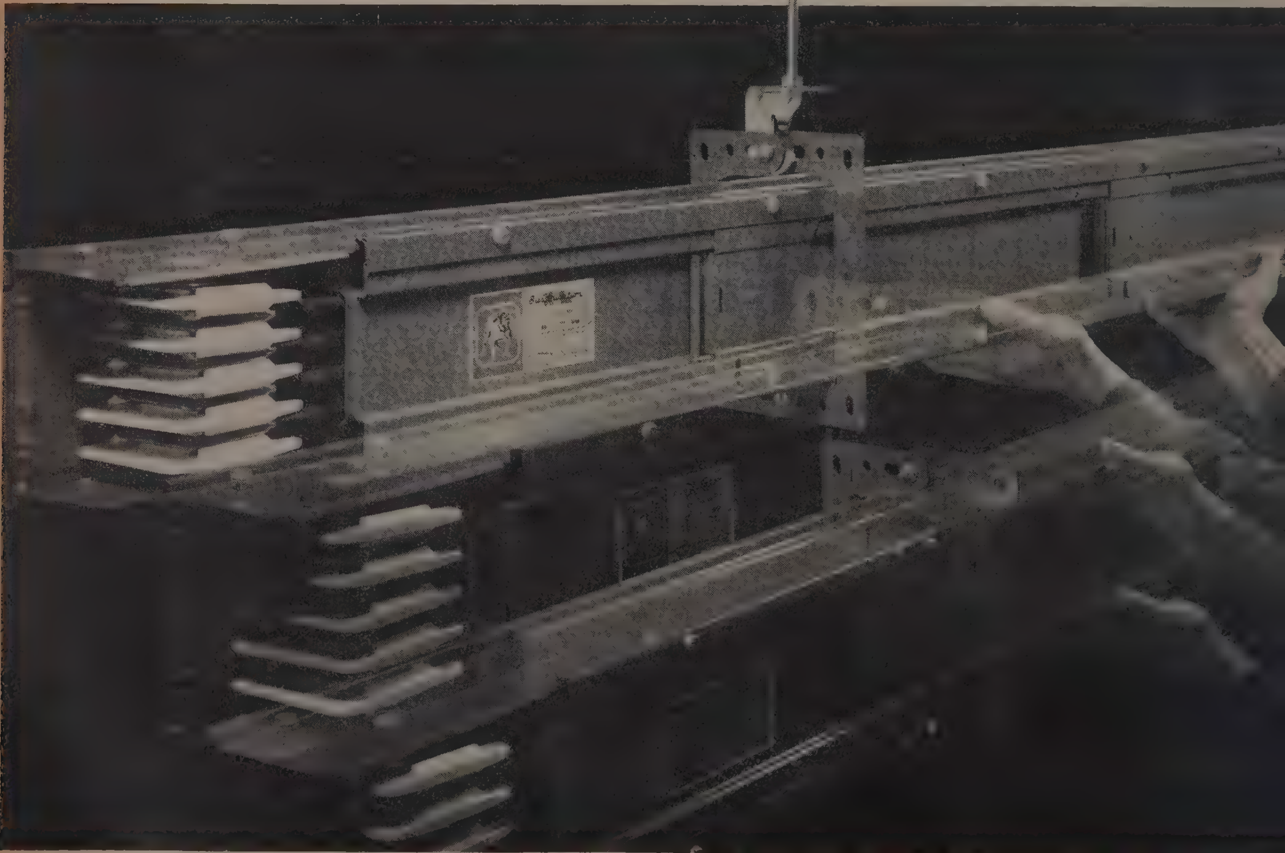
This symbol stands for bus duct

This symbol stands for QUALITY

NOW... BullDog plug-in duct hangs up to 50% faster

with new HANGFAST® Adapter

New HANGFAS
Adapter bolts quickly an
tightly to suspension ro
end . . . duct with stanc
ard hanger engage
HANGFAST Adapter hook instantl
. . . hanger bolt spins tight fast for
lasting, secure installation. Result-
you can save as much as 50% i
hanging time . . . end time-consumin
bracket fabrication, too! And you ca
use the new HANGFAST Adapte
with all types of BullDog industria
plug-in duct systems—XL, BD an
LO-X®. Ask your BullDog Field Rep
resentative for a demonstration. C
write for details.



BullDog Electric Products Division, I-T-E Circuit Breaker Company, Box 177, Detroit 32, Mich. In Canada: 80 Clayson Rd., Toronto, Ont. Export Division: 13 East 40th St. New York 16, N.Y

I-T-E

I-T-E CIRCUIT BREAKER COMPANY
BULLDOG ELECTRIC PRODUCTS DIVISION

ELECTRICAL
CONSTRUCTION
AND MAINTENANCE

Providing for homeowner's needs is key to . . .

Selling-Up Residential Wiring

Here's how enterprising electrical contractors can successfully attack the big market for house wiring—with a planned program, based on sound principles of promotion and merchandising and aimed at giving each homeowner a "custom-tailored" wiring system.

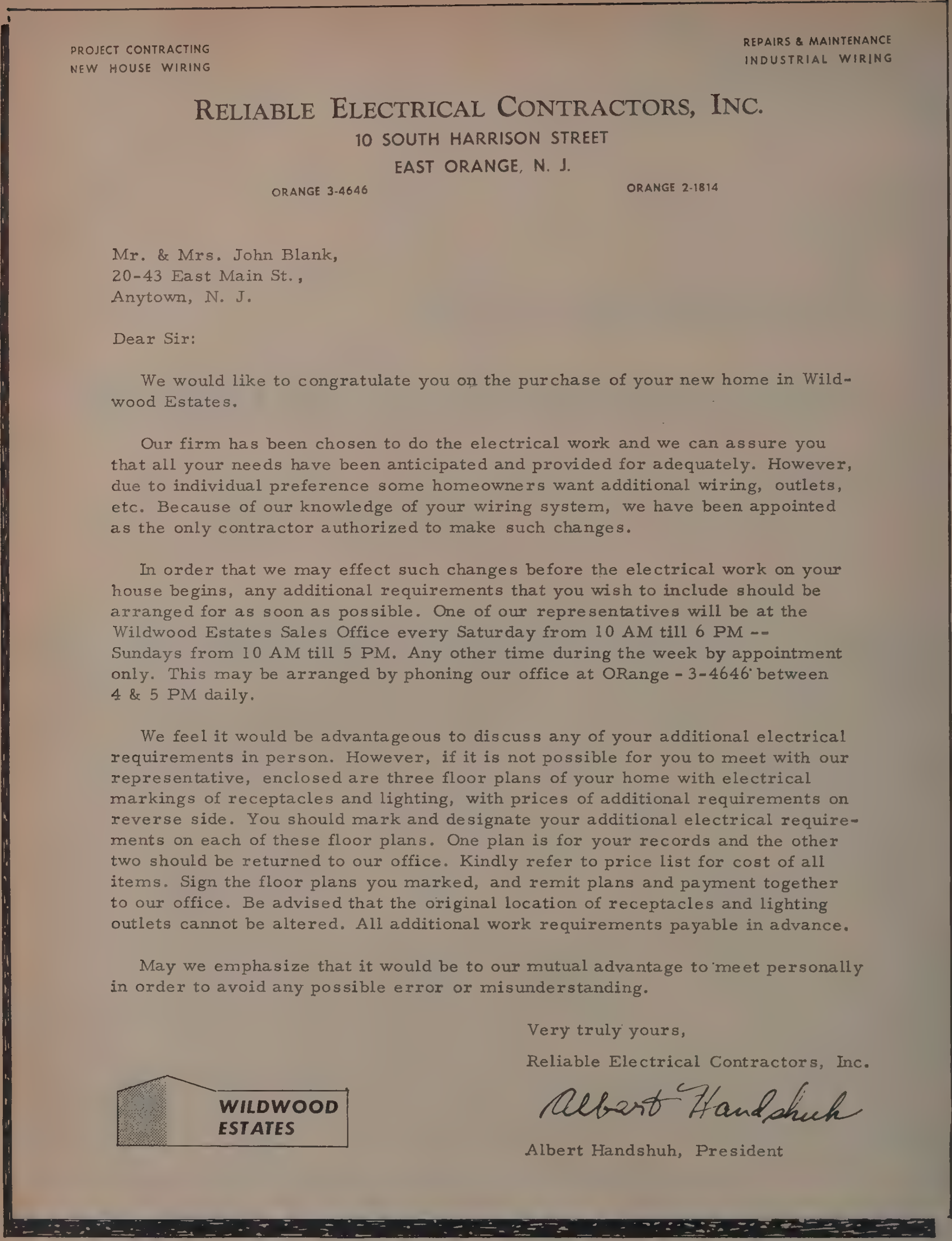
By Albert Handshuh, *President, Reliable Electrical Contractors, Inc., East Orange, N. J.*

A PLANNED program — carefully conceived, well organized and realistically executed—is the key to successful residential wiring business for Reliable Electrical Contractors, Inc. This overall program is designed to give new homeowners the opportunity to get a custom wiring system for the types of light and power loads they want. The benefits to the contractor are a continually expanding volume of work, pleasant and enjoyable customer relations, and the personal satisfaction of an imaginative and creative contribution to modern electrical living for the homeowner.

The "electrical living" program described here is not just a theory. It is an actual detailed procedure—tested and proved over years af application—for maximizing the business potential of electrical contracting in large-scale housing developments. From a business standpoint, this program has consistently boosted volume of electrical work anywhere from 20% to 40% for each housing project. The following sets forth the details of the program.

Reliable's program for electrical living stems from the company's specializing in project contracting. The company's work force is organized for electrical installations in large-scale developments of individual residences. Expert on-the-job supervision is provided by William Malbaurn, general superintendent and John Hufford, assistant superintendent. Thoroughly experienced in this specialty, Reliable contracts for the basic wiring of all the houses in a development. But, the "electrical living" program just begins when the contract is arranged for installing the basic electrical system that goes with the builder's price of each house.

The fundamental objective of the "electrical living" program is the same in every development: to contact the purchaser of each house before the house is built and offer the purchaser electrical wiring capacity tailored exactly to present and future loads. The purchaser is first advised as to the load handling capability of the basic wiring system which is installed with the house. Then depending upon the purchaser's desires for more lighting and appliance loads or for more convenience receptacles, a higher capacity system with more extensive circuitry than the basic system is worked out to afford modern electrical living. Of course, the most desirable way of satisfying the homeowner's needs is for the contractor to meet with Mrs. and Mr. and through discussion arrange for the electrical system which will best serve their needs. However, to provide the same opportunity when such personal get-together cannot be arranged, the program includes a mail-order plan for selecting additions to the basic system provided in the price of the house.



PROJECT CONTRACTING
NEW HOUSE WIRING

REPAIRS & MAINTENANCE
INDUSTRIAL WIRING

RELIABLE ELECTRICAL CONTRACTORS, INC.
10 SOUTH HARRISON STREET
EAST ORANGE, N. J.
ORANGE 3-4646
ORANGE 2-1814

Mr. & Mrs. John Blank,
20-43 East Main St.,
Anytown, N. J.

Dear Sir:

We would like to congratulate you on the purchase of your new home in Wildwood Estates.

Our firm has been chosen to do the electrical work and we can assure you that all your needs have been anticipated and provided for adequately. However, due to individual preference some homeowners want additional wiring, outlets, etc. Because of our knowledge of your wiring system, we have been appointed as the only contractor authorized to make such changes.

In order that we may effect such changes before the electrical work on your house begins, any additional requirements that you wish to include should be arranged for as soon as possible. One of our representatives will be at the Wildwood Estates Sales Office every Saturday from 10 AM till 6 PM -- Sundays from 10 AM till 5 PM. Any other time during the week by appointment only. This may be arranged by phoning our office at ORange - 3-4646 between 4 & 5 PM daily.

We feel it would be advantageous to discuss any of your additional electrical requirements in person. However, if it is not possible for you to meet with our representative, enclosed are three floor plans of your home with electrical markings of receptacles and lighting, with prices of additional requirements on reverse side. You should mark and designate your additional electrical requirements on each of these floor plans. One plan is for your records and the other two should be returned to our office. Kindly refer to price list for cost of all items. Sign the floor plans you marked, and remit plans and payment together to our office. Be advised that the original location of receptacles and lighting outlets cannot be altered. All additional work requirements payable in advance.

May we emphasize that it would be to our mutual advantage to meet personally in order to avoid any possible error or misunderstanding.

Very truly yours,

Reliable Electrical Contractors, Inc.

Albert Handshuh

Albert Handshuh, President

WILDWOOD ESTATES

FIG. 1—Form letter sent to each and every purchaser of a house in a development wired by Reliable Electrical Contractors. Right now, as an example, letters are going out to those who have purchased houses in the 300-home development at Harold Kramer's Rolling Hills at Wayne, N. J.—homes in the $21,000 class.

The program very realistically recognized some facts about selling electrical utilization. It recognized that many of the purchasers of these new homes have had some experience with electrical inadequacy. People who have lived in older houses or apartments (or even new houses or apartments in many cases) have had difficulty in taking advantage of the many desirable, work-saving electrical appliances on the market today. These appliances include air conditioners, clothes washers, dishwashers and such high-wattage devices as broilers, rotisseries, electric fry pans, toasters, etc. For such people, it is only necessary to suggest the need for a modern electrical wiring job to sell it. For some other people, it is necessary to discuss the requirements of modern electrical living before they can be sold. Then there is always a percentage of people who, for varying reasons, just cannot be sold. Reliable's program attempts to make sales expeditiously and firmly whenever possible, without wasting any time on the "stone walls."

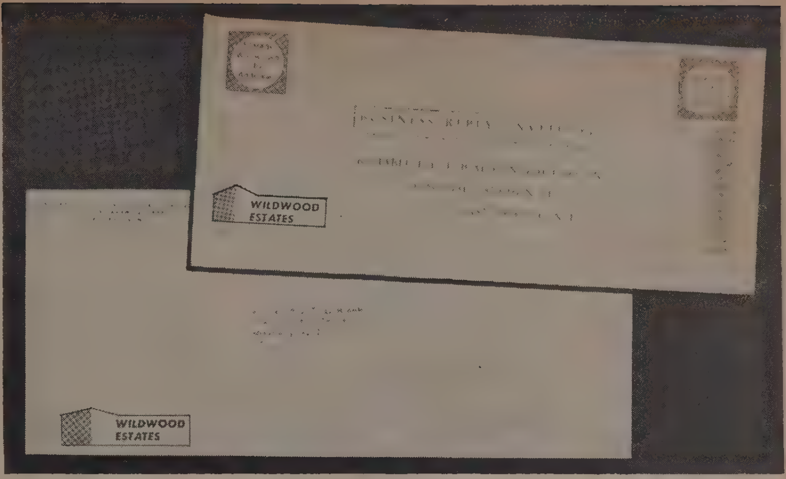


FIG. 2—Mailing envelopes used in the "electrical living" mail-order plan include the one at bottom in which all of the literature is sent to the homeowner and the one at top which is used by the homeowner to return the two sets of work sheets indicating the extent of electrical additions he wants. Note the use of the builder's emblem for the development on the envelopes. In any particular case, the emblem —which is used by the builder in newspaper ads, for direct mail, on roadside billboards and on all of the builder's stationary—is completely familiar to the homeowner by the time he purchases a home. As a result, the use of the emblem adds pertinence and importance to Reliable's correspondence and prompts the homeowner to carefully investigate the proposal because of its relationship to the very big step he has taken in buying a house.

In the case of a typical development, the "electrical living" program works like this:

1. Reliable is notified by the builder that Mr. and Mrs. Blank have purchased a particular model of home in a development.

2. A package of literature is sent by Reliable to Mr. and Mrs. Blank, containing—

A. **A form letter** congratulating them and offering to meet their needs for a tailored electrical system. This letter sets forth the essence of the program. See Fig. 1 on page at left.

B. **Three sheets of floor plans,** each containing the same data. Each sheet has a floor plan showing the basic lighting and receptacle outlets and switch locations for the model of house Mr. and Mrs. Blank purchased, a set of symbols to be used in marking electrical changes on the floor plan (Fig. 3) and, on the reverse side, an itemized list of electrical additions to the house with a unit price for each electrical item (Fig. 4).

Use of the floor-plan sheets is explained in the form letter. The homeowner fills out all three of the sheets with the same data, in accordance with his needs for more electrical circuiting. Two of the sheets are returned to Reliable and one is retained for the homeowner's record. Of the two copies received by Reliable, one is kept in the office for a record, and the other is given to the electrician who goes to do the work on the house when it gets under construction.

C. **A postage-paid, business reply envelope** addressed to Reliable Electrical Contractors, in which the homeowner can return the two floor-plan sheets on which he has noted the electrical work he wants done. See Fig. 2.

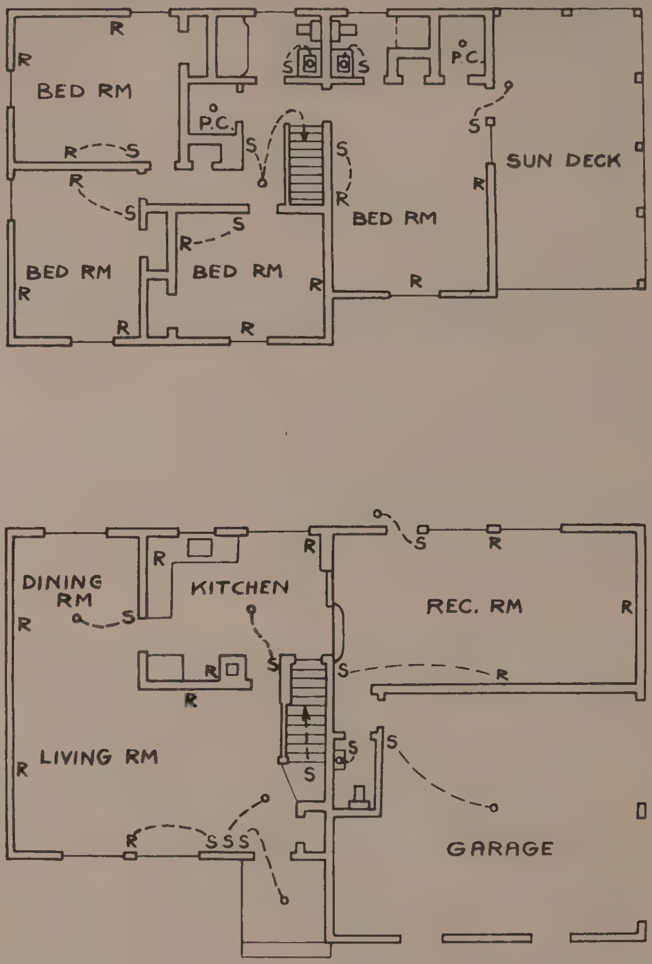
3. Then, depending upon the response from the mailing, a discussion will be arranged with the homeowner or the job will be installed as per the marked floor-plan sheets.

In effect, the returned floor-plan sheets constitute a firm job order. Note that the customer signs the sheets and remits payment in advance. All terms and conditions are clearly known and duly recorded. The work order and specific details of the work are set down in the customer's own handwriting. The contractor, under this arrangement, cannot be subjected to misunderstandings or objections on the part of the customer. There can be no claims that "this is not where I wanted the outlet"—or switch or lighting fixture, or etc. The functional features of the work are chosen by the customer, who marks outlets on the floor plans and who gets exactly what he requested. All around, this plan produces more and better work for the contractor, with excellent customer relations at all times.

Office organization for the "selling-up" program is simple and straightforward. A 3 by 6 ft, floor-standing, metal shelving unit is compartmented to store the various literature—floor-plan sheets, form letters, envelopes, etc. The floor-plan sheets for each development are individually color coded for ready identification, i. e., green for project A, yellow for project B, etc. And for each development, the groups of floor plans are further broken down according to the specific models of houses available—split-level, ranch, 2-story, etc. The pile of form letters for each development is set in a separate shelf compartment. With this shelving arrangement, the necessary stationery elements can be readily picked out and assembled for mailing to each new house purchaser.

An interesting refinement on the above system is the use of the builder's emblem on the form letter and envelope to identify the particular housing project. By this device, the association between the contractor and the project itself is emphasized to convey organized

WILDWOOD ESTATES – COLONIAL MODEL



ELEC. SYMBOLS*

S – Switch
R – Recept.
O – Light
X – Tele. Conduit
AC – Window Air Cond.
M – Mangle
F – Freezer
P – Power Tool
D – Dryer
LP – Lamp Post
CO – Clock Outlets
WP – Weather proof outlet
PC – Pull Chain

*The amounts, items and unit prices printed on the reverse side of this sheet are agreed to and accepted by Customer.

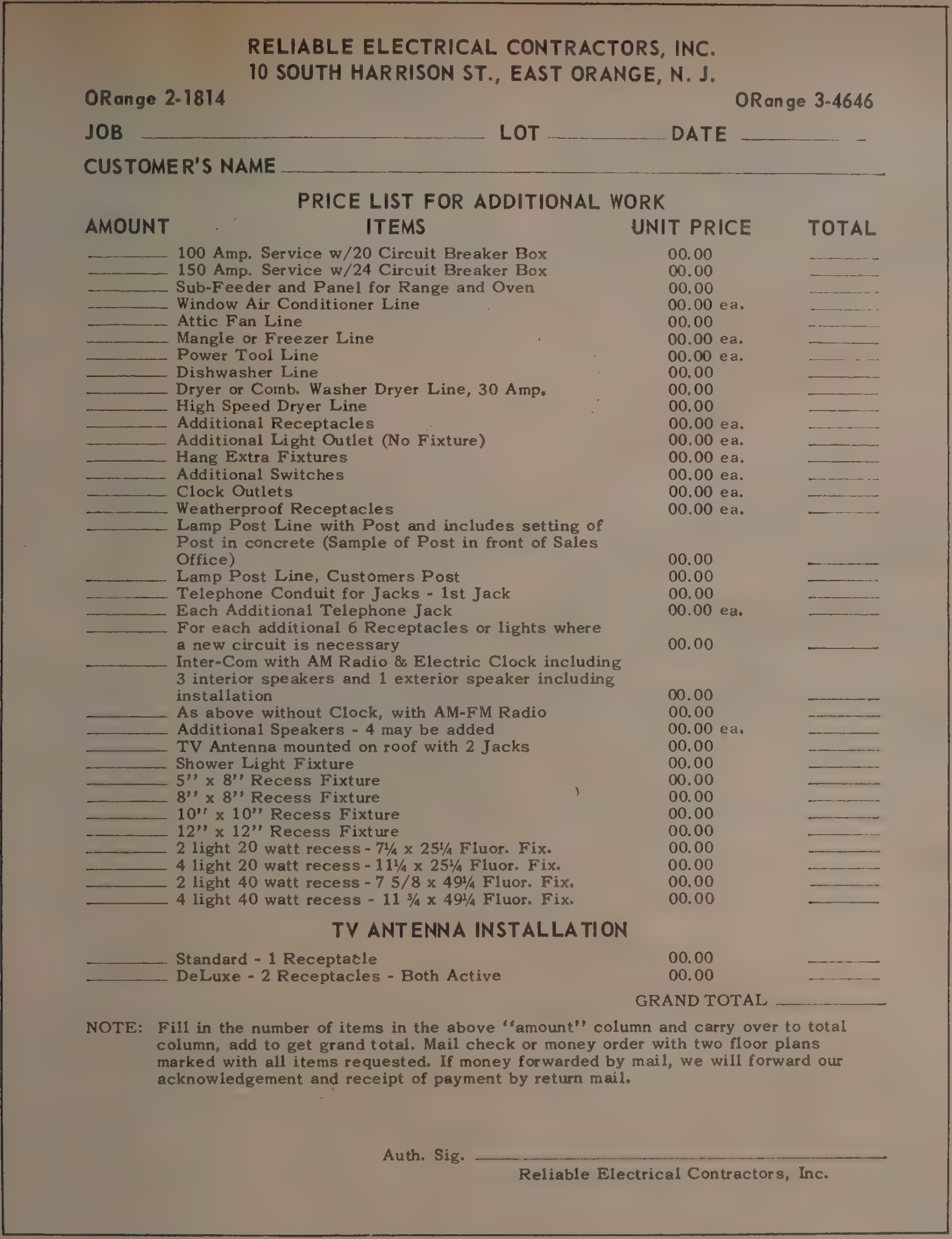
Customer's Signature ______________________ Date ______________________

(RETURN TWO SIGNED COPIES TO RELIABLE ELECTRICAL CONTRACTORS, INC.)

FIG. 3—One side of the "electrical living" work sheet for the homeowner contains a floor plan of the model of home he purchased, with indications of the electrical outlets which go with the basic price of the house. Any additional electrical facilities can be readily noted on this floor plan by the homeowner, using the symbols given. As an interesting sidelight, home purchasers use these floor plans for furniture layouts.

joint responsibility in satisfying the customer's needs. And the presence of the project emblem on the mailing envelope indicates that the contents have something to do with their recent purchase of a house in the development. This minimizes discarding of the material as "just another promotional flyer" and gets the customer to look into the proposal carefully.

In practice, Reliable has found that about 60-80% of the purchasers of homes in any project "sign-up" for more wiring than that provided in the basic price of the house. And this up-wiring work can be directly traced to the organized sales campaign. As an example, if $300 per house is the contractor's price for the basic 60-amp service and sys-



RELIABLE ELECTRICAL CONTRACTORS, INC.
10 SOUTH HARRISON ST., EAST ORANGE, N. J.

ORange 2-1814 **ORange 3-4646**

JOB ________________ **LOT** ________ **DATE** ________

CUSTOMER'S NAME ________________________

PRICE LIST FOR ADDITIONAL WORK

AMOUNT	ITEMS	UNIT PRICE	TOTAL
	100 Amp. Service w/20 Circuit Breaker Box	00.00	
	150 Amp. Service w/24 Circuit Breaker Box	00.00	
	Sub-Feeder and Panel for Range and Oven	00.00	
	Window Air Conditioner Line	00.00 ea.	
	Attic Fan Line	00.00	
	Mangle or Freezer Line	00.00 ea.	
	Power Tool Line	00.00 ea.	
	Dishwasher Line	00.00	
	Dryer or Comb. Washer Dryer Line, 30 Amp.	00.00	
	High Speed Dryer Line	00.00	
	Additional Receptacles	00.00 ea.	
	Additional Light Outlet (No Fixture)	00.00 ea.	
	Hang Extra Fixtures	00.00 ea.	
	Additional Switches	00.00 ea.	
	Clock Outlets	00.00 ea.	
	Weatherproof Receptacles	00.00 ea.	
	Lamp Post Line with Post and includes setting of Post in concrete (Sample of Post in front of Sales Office)	00.00	
	Lamp Post Line, Customers Post	00.00	
	Telephone Conduit for Jacks - 1st Jack	00.00	
	Each Additional Telephone Jack	00.00 ea.	
	For each additional 6 Receptacles or lights where a new circuit is necessary	00.00	
	Inter-Com with AM Radio & Electric Clock including 3 interior speakers and 1 exterior speaker including installation	00.00	
	As above without Clock, with AM-FM Radio	00.00	
	Additional Speakers - 4 may be added	00.00 ea.	
	TV Antenna mounted on roof with 2 Jacks	00.00	
	Shower Light Fixture	00.00	
	5'' x 8'' Recess Fixture	00.00	
	8'' x 8'' Recess Fixture	00.00	
	10'' x 10'' Recess Fixture	00.00	
	12'' x 12'' Recess Fixture	00.00	
	2 light 20 watt recess - 7¼ x 25¼ Fluor. Fix.	00.00	
	4 light 20 watt recess - 11¼ x 25¼ Fluor. Fix.	00.00	
	2 light 40 watt recess - 7 5/8 x 49¼ Fluor. Fix.	00.00	
	4 light 40 watt recess - 11 ¾ x 49¼ Fluor. Fix.	00.00	

TV ANTENNA INSTALLATION

	Standard - 1 Receptacle	00.00	
	DeLuxe - 2 Receptacles - Both Active	00.00	

GRAND TOTAL ________

NOTE: **Fill in the number of items in the above "amount" column and carry over to total column, add to get grand total. Mail check or money order with two floor plans marked with all items requested. If money forwarded by mail, we will forward our acknowledgement and receipt of payment by return mail.**

Auth. Sig. ________________________
Reliable Electrical Contractors, Inc.

FIG. 4—Other side of the work sheet contains the various additional items of electrification with unit prices indicated for each item. The homeowner fills in the number of each additional item desired and then multiplies by the given unit price to mark the dollar total for each item. Although they are not indicated on this sample sheet, the unit prices appear on the work sheet as it goes to a homeowner.

tem in a house, an average extra of $90 per house can be expected, based on all of the houses even if some of the houses have no extra wiring at all. Where $350, say, is the per house contractor's figure for a 100-amp service and system, average extra amounts to $70 per house for every house in the project.

A look at the wide range of available wiring details (from the accompanying reproduction of the "electrical living" price sheet) will readily account for boosts in work volume. The popularity of air conditioners, electric ranges, electric dryers, dishwashers, built-in TV antenna-systems, etc., explains the relative ease with which additional wiring for such devices can be readily sold.

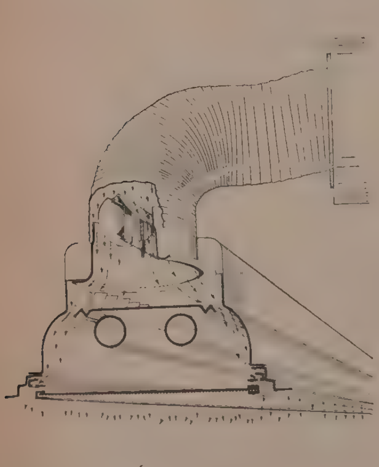
WIRING COUPLERS are added to the 4-ft troffer bodies before installation. Troffers have 6-in. extension plates at ends to span 5-ft T-bar module.

ELECTRICIANS "LAY" troffers in T-bar module, fasten couplers and complete wiring connections. Following air duct connections, they return to install plates, lamps and lenses.

Chicago Bank Gets

Lighting, Heating, Cooling From Luminaires

Combination light and air diffuser fixtures provide comfort conditioning throughout the Harris Trust and Savings Bank's new 23-story office building. Modular design permits flexibility of partition arrangements.



SECTIONAL VIEW of Lumi-flo troffers, the combination lighting and conditioned air diffusing units used throughout Harris Trust's new office building.

ILLUMINATION and conditioned air come from the same lighting fixtures in the new 23-story office building of the Harris Trust and Savings Bank, Chicago. Modular installation permits complete flexibility and freedom of office layout without affecting lighting or air distribution results.

The imposing new structure, with service cores outside the main building area, represents an outstanding example of open-area construction providing large unobstructed floor space. The structural steel skeleton is faced with stainless steel curtain wall panels incorporating large glass areas. Twelve floors are taken over by the bank; the other 11 floors are rental occupancy.

Prime factor in the comfort conditioning (illumination, heat, cooling, sound control) is the modular ceiling design and arrangement of the combination light-air fixtures throughout the 287,000 sq ft of office space. Basic grid for the suspended ceiling is a complex of inverted T-bars forming 5-ft by 5-ft modules throughout each floor area. Each module provides occupants with evenly distributed lighting (65 footcandles throughout), low-velocity supply and return air (75 cfm per troffer), and sound-absorbing acoustic panels. If the module parameters are maintained, these design characteristics remain constant regardless of where partitions are located or moved.

In the center of each ceiling module is a 1-ft by 4-ft, two-lamp, recessed, lay-in fluorescent troffer with integral air diffuser and volume control connected by flexible tubing to air ducts above the grid. Lamps are 40-watt, warm

SHEET-METAL WORKER installs air diffuser, air volume control valve, and 5-in. dia. flexible tubing connection to overhead air duct system.

FINISHED CEILING forms a pattern of 5-ft squares, each with a recessed light-air troffer and acoustic panels. Perimeter air induction units are under windows.

OPEN AREA office space gets 65 footcandles of evenly distributed illumination and low-velocity; well-diffused conditioned air from ceiling "lighting" fixtures.

PRIVATE OFFICES can be sized, located, or moved on any multiple of the basic ceiling module without changing lighting, conditioned air facilities or acoustical treatment.

white, rapid-start type shielded by a Corning 93 Albalite troffer lens. Each end of the 4-ft troffer has a 6-in. metal extension plate to span the 5 ft between T-bars. The module enclosure is completed with two 2-ft by 5-ft lay-in panels of matte finish fibre glass ceiling board, one on each side of the troffer.

The over-all lighting pattern is that of rows of recessed troffers on 5-ft centers. Mounting height is 9 ft. The 12-in. space between ends of troffers is bridged by wireway couplers which enclose wiring between fixtures grouped on a circuit. In general, lighting is group controlled from distribution panels in floor electrical closets. Private offices have wall switches. A total of 9,867 combination light-air troffers were installed in this manner.

Underfloor ducts provide distribution facilities for telephone and electrical service.

Main air-handling equipment is housed on the 11th floor. Supply and return duct risers feed up and down to provide air distribution to the second through the 22nd floor of the building. Total cfm is 324,000. There are approximately six air changes per hour. Air volume per lighting troffer is 75 cfm for input and exhaust. Supply from the diffuser is at 56° F with rooms maintained at 76° F. Humidity is 13% at a temperature of 25° F; thereafter humidity decreases with a drop in outside temperature.

The large glass areas of the curtain walls are blanketed with perimeter heating and cooling units which deliver air from the base of the windows and return it through the ceiling. These induction units, installed at outside windows, are generally capable of conditioning air 15 ft horizontally from the perimeter of the building. High pressure, high-velocity, 2000-3500 fpm air serves the induction units. Medium pressure, medium velocity air serves the ceiling troffers.

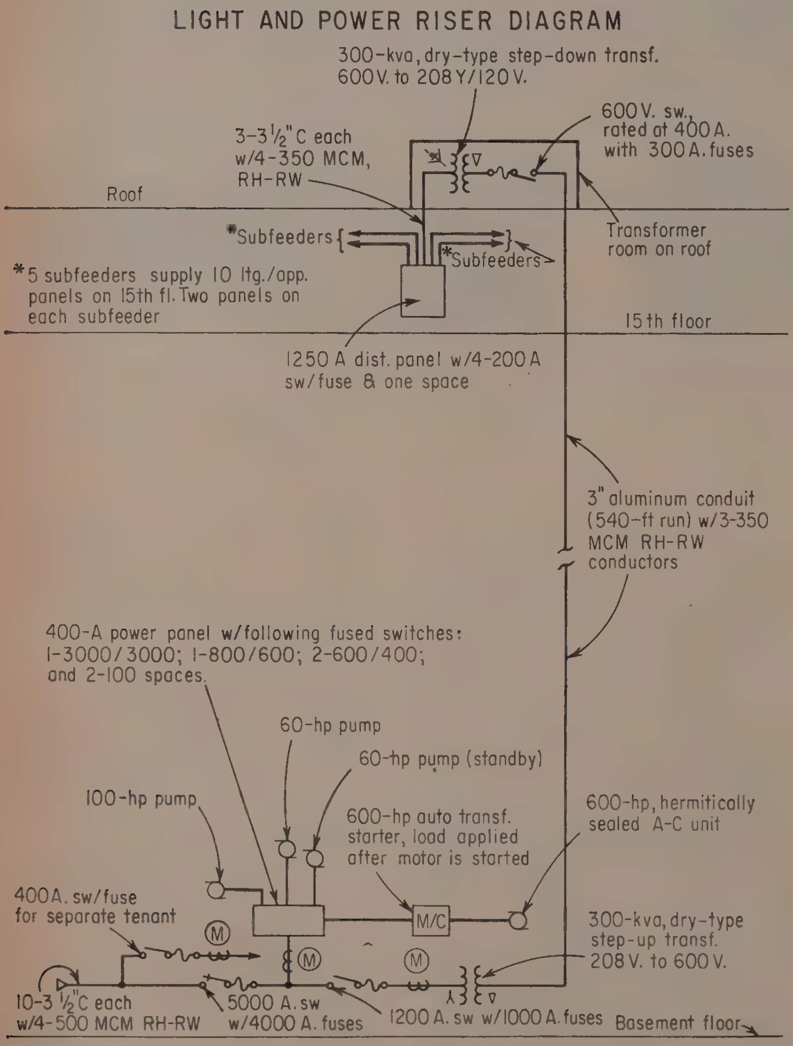
Air is filtered through a system consisting of a prefilter of an automatic roll type, followed by a dry type unit filter using a renewable media. Dirt is no problem with the ceiling troffers. Dirt particles are slowly recirculated and gradually drawn into the air returns where they are eventually filtered out in the equipment room.

Skidmore, Owings and Merrill, architects and engineers, designed the building. Turner Construction Company was the general contractor. The complete electrical installation was made by Emerson-Comstock Co., Inc.

Clever Design Techniques Solve . . .

Office Wiring Problems

Formerly an attic storage space, the top floor of the 15-story Wanamaker Building in New York City has been converted into a spacious office area. Here's an account of how the consulting engineers solved some difficult problems concerning risers, lighting and air conditioning.


LIGHT AND POWER RISER DIAGRAM
300-kva, dry-type step-down transf. 600V. to 208Y/120V.
3-3½" C each w/4-350 MCM, RH-RW
600V. sw., rated at 400A. with 300A. fuses
Roof
*Subfeeders
*Subfeeders
Transformer room on roof
*5 subfeeders supply 10 ltg./app. panels on 15th fl. Two panels on each subfeeder
15th floor
1250 A dist. panel w/4-200A sw/fuse & one space
3" aluminum conduit (540-ft run) w/3-350 MCM RH-RW conductors
400-A power panel w/following fused switches: 1-3000/3000; 1-800/600; 2-600/400; and 2-100 spaces.
60-hp pump
60-hp pump (standby)
100-hp pump
600-hp auto transf. starter, load applied after motor is started
600-hp, hermetically sealed A-C unit
400A. sw/fuse for separate tenant
M/C
M
M
M
300-kva, dry-type step-up transf. 208V. to 600V.
10-3½"C each w/4-500 MCM RH-RW
5000 A. sw w/4000 A. fuses
1200 A. sw w/1000 A. fuses
Basement floor

FEEDER PROBLEM is solved by installing 600-volt risers from the basement to the 15th floor. Two 300-kva, dry-type transformers provide step-up, step-down transformation for the 540-ft feeder. The 5000-amp main switch for the new 15th floor load also supplies power loads for a 600-ton, hermetically sealed air conditioning unit.

WHEN the Strand Management Corporation, owners of the Wanamaker Building, decided to convert the attic storage space into a 60,000-sq-ft office area, they presented a number of problems to their consulting engineers, M. P. Zacharius and Associates of New York City.

Major electrical problems related to providing feeder capacity of 300 kva to the new 15th-floor office area; installing uniform lighting from a 9-ft ceiling; and air conditioning this large area. Solutions were the use of 600-volt risers to handle the general lighting and office equipment loads; clear, prismatic dropped diffusers for recessed fluorescent luminaires in the office area; and a 600-ton air conditioning unit to augment the existing central air conditioning plant.

Distribution

Power company supply from an underground network could only be obtained at 208Y/120 volts without a long delay.

As a result of the new lighting and air conditioning loads, a separate 4000-amp service at 208Y/120 volts had to be installed.

Ten 3½-in. conduits, each containing four 500MCM RH-RW conductors, run from the power company stabs to a 5000-amp pressure-contact service switch containing 4000-amp HIC fuses. From the load side of the service switch, a 4000-amp bus extends to the motor load center for air conditioning equipment. Also the bus feeds a 1200-amp switch containing 1000-amp fuses.

LINE TERMINAL CONNECTIONS to 5000-amp service switch are paralleled 10 per leg. Pull box (upper left) was custom-made to fit service switch. Ten 3½-in. conduits, each containing four 500MCM RH-RW conductors enter the rear of pull box. Service fuses are 4000-amp HIC type.

VENTILATED BUSWAY, rated at 4000 amps extends from the load side of main 5000-amp switch (left) to custom 1200-amp feeder switch, fused at 1000 amps. Arrow points to bus tap which feeds 4000-amp power panel in adjacent room. 1200-amp feeder switch provides 208-volt, 3-wire, 3-phase supply to primary of 300-kva step-up transformer.

FLOOR-MOUNTED, 300-kva, dry-type transformer steps up 3-phase voltage from 208 volts to 600 volts. In the foreground, an 8-in by 10-in. wireway, containing nine 350MCM conductors (three per leg), ties into large primary-supply terminal box. To the left of electricians for Benjamin Electric, a 3-in. aluminum conduit is connected to pull box.

600-VOLT FEEDER extends from basement to transformer room above 15th floor. The 3-in. aluminum conduit contains three 350MCM conductors, which supply primary of step-down transformer. Three 3½-in. conduits (grouped to the left) contain four 350MCM conductors which supply 208Y/120-volt supply to distribution panelboard on the other side of stairway wall.

ROOF TRANSFORMER ROOM houses 300-kva, step-down dry-type transformer. Safety switch, 400 amps with 300-amp fuses, is mounted on pull box and provides control and protection for 600-volt feeder which is connected to transformer primary. Pull box contains both primary (600 volts) and secondary (208Y/120-volt) conductors. Conduits enter bottom of pull box.

DISTRIBUTION PANELBOARD is rated at 1250 amps, 208Y/120 volts and contains five 200-amp fused feeder switches. Each 200-amp disconnect supplies two lighting and appliance branch-circuit panelboards, similar to those shown on each side of distribution panel. This load center handles general lighting and office equipment loads for the 15th floor of the Wanamaker Building.

The 1200-amp switch is for the 300-kva, 208Y/120-volt, general loads on the 15th floor. Ordinarily, conductors would be extended directly from the feeder switch in the basement to the feeder distribution panelboard on the 15th floor. This would require three 3½-in. conduits with three sets of four 500-MCM conductors; a very costly item in an existing building where the conduit runs are to be 540 ft in length. But in lieu of this costly procedure, a sound engineering analysis resulted in a much less expensive method of installing the 300-kva riser.

From the 1200-amp switch, nine 350 MCM conductors (three per phase) at 208 volts extend a short distance to a 300-kva dry-type transformer incorporating Class H (150°C) windings. There the 3-wire, 208-volt supply is wye-connected to the transformer primary. Secondary voltage is stepped up to 600 volts, 3-wire delta. This provided about a 1:3 step-up voltage ratio and conversely, a 3:1 reduced secondary current. As a result, only one 3-in. aluminum conduit, containing three 350MCM RH-RW conductors, had to be installed the 540-ft distance to the 15th floor load center.

After extending across the basement area, the 600-volt riser runs up an abandoned elevator shaft to the 11th floor. From there, it continues up a stairwell to a transformer room built on the roof directly above the 15th floor. Here the riser terminates in a 3-pole, 600-volt, 400-amp safety switch fused at 300 amps. Then the 600-volt conductors are delta-connected to the primary of another 300-kva dry-type transformer which steps down the voltage to 208Y/120 volts again. Three 3½-in. conduits containing three sets of four 350 MCM run about 15 ft to a 1250-amp, 208Y/120-volt feeder distribution panelboard on the 15th floor below. Containing five active fused 200-amp switches, this panelboard distributes subfeeders to ten lighting load centers throughout the 15th floor. Two branch-circuit panelboards are connected to each subfeeder.

Even though two 300-kva transformers (one step-up and one step-down) and a roof transformer room were required for the 600-volt vertical riser, estimators for the Benjamin Electric Engineering Works, N. Y. C., the electrical contractor for this project, stated that this method provided substantial savings over using larger capacity risers at 208Y/120 volts.

Lighting the general office area presented another problem. Lease requirements insisted on 50 maintained footcandles with a maximum drop of 14% (7-fc) between fixture rows. Because of a 9-ft ceiling, this complicated matters somewhat. However, after considerable research and tests by the engineer and fixture manufacturer, continuous-row, recessed fluorescent fixtures (2-tube, T-12, 96 in.) with dropped lenses were selected.

By using dropped-curved clear-prismatic lenses, horizontal light spread was increased sufficiently to conform with the lease requirements. And this was accomplished with an 11-ft spacing between fixture rows.

In the file room area, U-channel, suspended from the ceiling, provides rigid support for single-tube fluorescent strip units.

LUMINOUS STRIP LIGHTING extends along front of elevator landing to the 15th floor lobby of the Wanamaker Building. Continuous-strip units, 2-lamp 8-ft fluorescents are mounted above recessed ceiling. Diffuser panels fit openings. Recessed spots provide "punch" lighting through center of lobby, while circular fluorescent units provide soft light at rear of lobby.

RECESSED FLUORESCENT LUMINAIRE is one of five such units installed in the 15th floor lobby ceiling of the Wanamaker Building, New York City. Each unit contains ten 40-watt, 4-ft fluorescent lamps. Diffusers are frameless frosted-plastic circular covers that snap in place.

RUSS JOHNSON, electrical foreman for Benjamin Electric Co., shows how they used hollow metal office partitions as a wireway for armored cable. Wiring is easily installed because of snap-in baseboard sections. Removable baseboard sections are cut where receptacle outlets are installed.

As shown in accompanying photos, the lighting in the 15th floor lobby is a unique mixture of incandescent spots and fluorescent lighting, consisting of luminous strips and circular units.

Two-lamp, continuous-row fluorescents are mounted above the recessed ceiling in front of the elevator landing. Plastic diffusers, attached to the bottom side of suspended ceiling sections, provide an effective luminous strip in this area.

In the center of the lobby, recessed incandescent spots add punch lighting. And to balance this off, five circular recessed luminaires, each containing ten 4-ft 40-watt rapid-start fluorescent lamps with frameless, frosted-plastic flush diffusers, provide soft lighting at the rear of the lobby.

Over 5000 ft of single and double underfloor raceways provide complete flexibility for telephone and receptacle outlets in the office area. To install this duct, the existing concrete floor slab had to be channeled deep enough to permit fastening the duct to reinforcing steel. Following this, concrete was poured over the entire floor slab to cover the duct.

Another feature of the office wiring pertains to the permanent steel office partitions. These partitions contain snap-in covers and baseboards which can be easily removed. As a result, the partitions were used as raceway for armored cable.

Knowing the location of the partitions in advance, the electrical contractor stubbed up conduits from the floor slab to the wall partition space where a receptacle outlet was to be installed. Then after the partitions were installed, armored cables were extended from this outlet to switches and other receptacle outlets. Snap-in covers and baseboards were cut as required for each box opening.

FILE ROOM LIGHTING consists of single-tube fluorescent strips, secured to U-channel supports, which is turn are rod-suspended from the ceiling to below air conditioning ducts.

OVER 60,000 SQ FT of office space has been provided on the 15th floor of the Wanamaker Building. Space was formerly an attic storage area. Notice dropped curved lenses used with continuous row 2-lamp fluorescent units. This permitted wider horizontal light-spread which was required because of a low 9-ft ceiling. Lighting produces 50-maintained-fc with maximum drop of 7-fc between fixture rows spaced 11 ft. apart. Over 5000 ft. of underfloor raceway was installed in office floor areas.

Air Conditioning

Prior to the 15th floor conversion, the central air conditioning equipment for the building was 2200-ton capacity. With an addition of a 60,000-sq-ft office space, this called for additional capacity. To handle this new load, a 600-ton air conditioning unit had to be added to the existing central equipment. This supplemental unit is powered by a 600-hp hermetically sealed motor supplied by 208 volts, 3-phase. The branch-circuit switch for this large motor is 3000 amps with 3000-amp fuses, and is located adjacent to the main 5000-amp equipment in the basement. Branch-circuit conductors consist of nine 600MCM RH-RW (three per phase in parallel) conductors, which gives a capacity of 1280 amps. Full-load current for the 600-hp motor is 1000 amps.

For starting the motor a NEMA Size 9 autotransformer-reduced-voltage magnetic starter is used. Until the motor has been brought up to speed, mechanical load is not applied, and the load will vary according to the demand on the existing central air conditioning plant.

Tom Toye, vice president of the Strand Management Corp., was the general construction superintendent for this project; electrical engineer was Al Turek of M. P. Zacharius & Associates; and the electrical superintendent was Sam Rabinowitz of Benjamin Electrical Engineering Works.

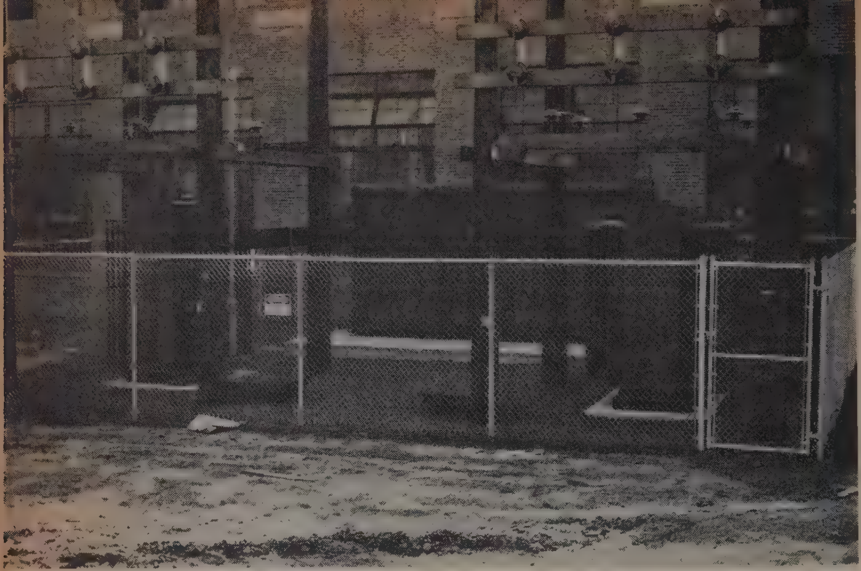


FIG. 1—Outdoor transformer yard contains structures for incoming primary line, the two oil-filled 1500-kva transformers, each on a concrete pad, and the double-ended, main CB switchboard in a weathertight, walk-in enclosure. A minimum distance limit was placed on the proximity of these oil-filled transformers to the plant building due to the hazard represented by the possibility of oil fire adjacent to the windows. The NE Code, in Section 450-25, requires that window openings in buildings be safeguarded from the fire hazard represented by oil-filled transformers installed outdoors adjacent to the window. The code recognizes space separation and the use of coarse crushed stone on the ground—both of which conditions exist here—as effective safeguards.

Industrial feeder circuits use . . .

THW Conductors

Economy and flexibility of power distribution are provided by circuits of THW-insulated conductors supported in ladder-type cable tray at the modernized industrial plant of Savage Arms Corp., Westfield, Mass. Electrical design was done by Chester Blumenauer, consulting engineer. Collins Electric Co., Springfield, Mass., installed the distribution system.

By J. F. McPartland

It should be carefuly noted that the cable tray wiring method used here is not covered by the National Electrical Code. It does not qualify as open wiring, is not cable system and does not use a code recognized raceway. However, the use of cable tray as a wiring method is not new and has been the subject of much discussion among code authorities over recent years. Systems using building wire in tray as a wiring method have been installed. In ever-increasing numbers, installations of neoprene-jacketed, multi-conductor cable circuits in tray have been and are being made. This latter method might be thought of as a non-metallic sheathed cable system, with the tray used purely as a support. Of course, such installations are not literally acceptable under the code unless the cable is designated type NM, NMC, UF or service entrance cable as permitted for interior wiring and installed in accordance with all code regulations on use of cable wiring methods. However, the installation here at the Savage Arms plant has been approved by the local inspection authority, acting within the permission granted to him in the code to approve special applications when, in his judgment, they are safe. And it is the firm conviction of the design engineer, based on experience, that cable tray with building wires constitutes a safe and efficient wiring method in certain cases, with sound engineering justification for its use.—**JFM**

AN UNUSUAL wiring method is the key to a modernized, high-capacity electrical system in the manufacturing plant of Savage Arms Corp., Westfield, Mass. Here, distribution of power is made with insulated building wire supported on an overhead system of ladder-type cable tray. Cost of this distribution system—for materials and labor—was substantially less than that of any alternative system. Conventional techniques—wire in raceway, busway or armored cable assembly—were evaluated at much higher values of dollars per kva delivered. And the wire-on-tray system best satisfied the several high-priority job requirements: low

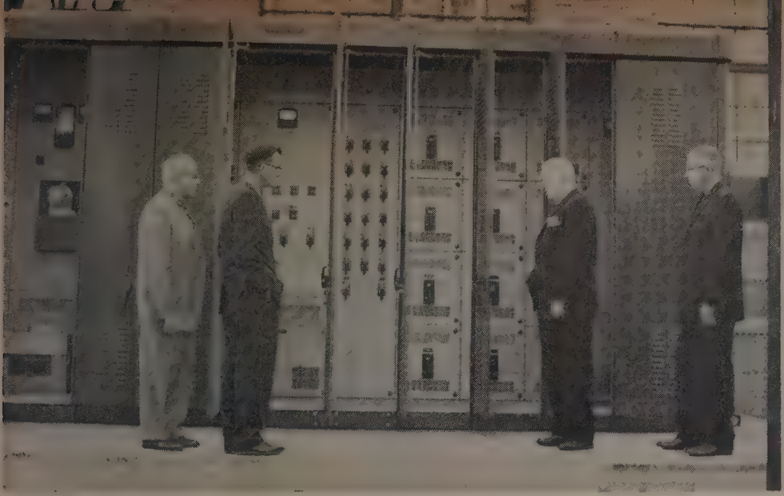


FIG. 2—Main switchgear contains manually and electrically-operated main and feeder breakers for each of the two, normally-separate sections of bus in the switchgear. The housing is a walk-in type. The four men shown here make up the team of electrical specialists responsible for the complete electrical system at the Savage plant. They are (L-R) Louis La Liberte, superintendent for Collins Electric Company; Robert McComb works manager for Savage; Chester Blumenauer, professional engineer and design consultant on this job; and William A. Collins of Collins Electric Company, installers of the distribution system.

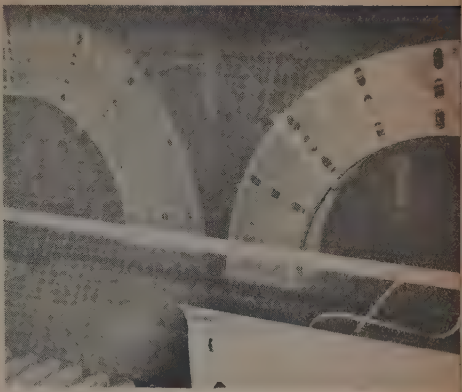


FIG. 3—Giant pullbox shown in lower left of this photo (looking up from the floor) is mounted about 18 ft above the plant floor against the inside building wall adjacent to the main outdoor switchgear. The conduit runs from the main switchgear can be seen coupling to the bottom of the box and the three main trunks of tray, carrying all of the plant feeders, are shown coupled to the box, from which point they supply the entire layout of tray sections and subsections. The tray sections are supported by trapeze hangers with their rods secured to framing channel fastened to wood floor joists above.

on Tray

first cost, flexibility for load relocations, and ready accessibility of conductors for easy maintenance and quick replacement when required by faults. A close look at this job points up the engineering considerations and construction methods.

Design Approach

This Westfield plant of Savage Arms Corp. is a modernized industrial building formerly occupied by a truck-trailer manufacturer. Considerable general construction went into the conversion of the facility to the manufacturing needs of Savage Arms. There was much concrete and steel work and the overall interior was completely revamped, within the basic shell of the building, to accommodate the manufacturing machinery moved from the old Savage plant at Chicopee Falls. All of the usable equipment from the old plant was moved to Westfield. This included plug-in distribution busway, transformers, lighting fixtures and the wide assortment of electrically powered machines used in making firearms. Based on all of the foregoing, design and construction of an electrical system for the modernized plant called for a high order of engineering skill and installation proficiency to correlate new construction requirements with remodeling phases of the electrical job.

Design of electrical distribution for the modernized plant had to start from scratch. For the previous trailer manufacturing operation, a 220-volt delta service to the plant was used to supply a demand load of 300 kva. Careful calculation of demand load for the modernized operations of Savage Arms dictated an installed supply capacity of 2200 kva. The old service and distribution had to be scrapped.

Consultation with the supplying utility company shaped the new service setup. The utility would meet the load requirements with two 1500-kva oil-immersed transformers from a pad outside the plant building. They would bring their primary to the transformers, and the electrical contractor for Savage would pick up the transformer secondaries. To provide the 440-volt supply required by machine motors, the transformer secondaries were connected 480-volt, 3-phase, 3-wire, ungrounded delta. And, of course, this 480-volt distribution level provided substantial economies in conductor capacities, raceways and sizes of circuit breakers, switches and controllers—compared with operation at a lower voltage level.

Selection of ungrounded operation of the 480-volt distribution system was specifically made for the

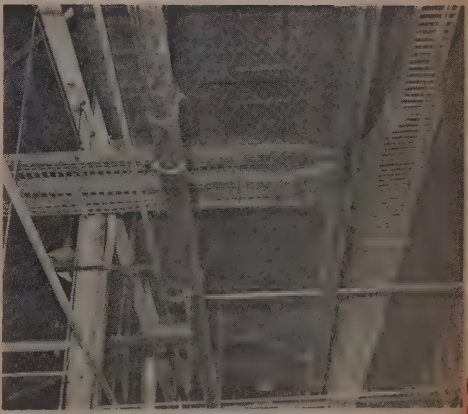


FIG. 4—Direction changes in the tray distribution system are readily made with curved tees and ells as shown here. Note the use of only one circuit in the reduced-size of tray at upper right of photo. This is typical of the extra capacity in the tray system here and indicates the ventilation condition for much of the system.

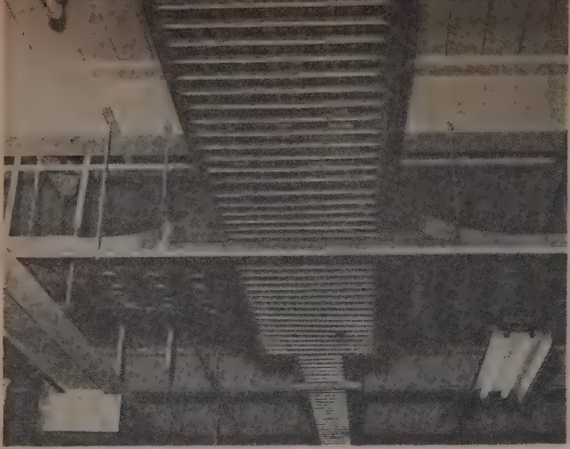


FIG. 5—Subfeed sections of tray originate from a main feeder tray (coming into picture at top) at the cross junction shown here. Some of the feeders turn off to the right, some to the left and some continue straight ahead. Note the rod hangers supporting the tray from the flange of the I beam.

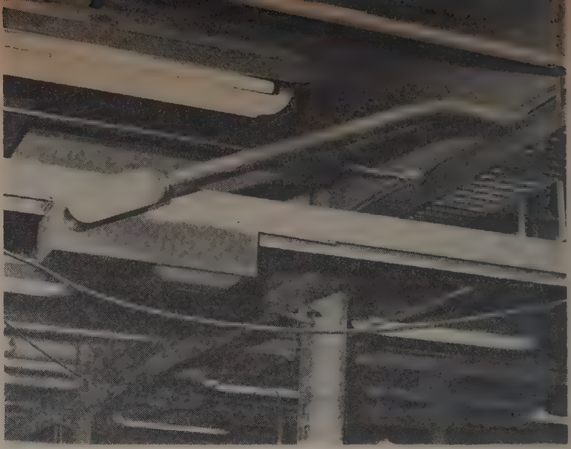


FIG. 6—Typical dropout of a feeder circuit from the tray is made in 3-in. conduit which is tightly clamped to the edge of the tray (upper right), assuring effective continuity and conductivity of the equipment ground path at this point. The other end of the conduit is terminated in the fused switch.

continuity advantages in industrial operations. With an ungrounded system, a ground fault on one phase will not operate the circuit protective device and thereby open the supply to the load. A 3-phase, 3-wire system can operate continuously with a ground fault on one phase just as if the fault ground were an intentional grounding of the system. And any number of additional ground faults may occur on the same phase without any effect on circuit operation. Only if a ground fault then developed on one of the other phases in the system, causing a phase-to-phase short circuit, would the fuses or CB protecting the conductors normally open the circuit. In a grounded system, however, ground fault on any ungrounded conductor will usually produce sufficient current flow to operate the overcurrent device, deenergizing the faulted circuit.

From the above, it is clear that an ungrounded system may offer a higher order of power continuity than a grounded system. Unanticipated power outages can be greatly reduced by the use of an ungrounded system. And since the vast majority of insulation breakdowns and faults in electrical systems are phase-to-ground faults, the ungrounded system will keep circuits operating when a grounded system would kill the power.

Chet Blumenauer, design engineer on the Savage job, prefers to use an ungrounded system with ground-detector lamp banks to quickly indicate a phase ground, permitting correction before a phase-to-phase fault develops. With such a setup, ground faults, when indicated, can be traced and eliminated under controlled conditions of power outage, minimizing downtime and consequent lost production. Chet pointed out that cost of lost production due to power failure in a nearby plant runs as high as $10,000 per hour of outage.

Chet Blumenauer's own 15 years of plant experience with ungrounded systems was a major factor in selection of such a system for Savage. The common disadvantages ascribed to ungrounded systems are—1) transient overvoltages, with resultant equipment damage due to insulation breakdowns, due to switching or arcing ground faults in the system; 2) operating overvoltage when one phase has a fault ground, with exposure to phase-to-phase faults of heavy and potentially hazardous currents; and 3) the difficulty of tracing and eliminating ground faults. In his experience, Mr. Blumenauer recalls only three cases of phase-to-phase faults, with only two motors lost as a result. Over the years, the cost of replacing those motors was nothing compared to the cost of lost production which would have resulted from outages due to one-phase ground faults on a grounded system.

At the outdoor transformer pad, the two transformers feed into the main circuit breaker switchboard in a walk-in, weatherproof enclosure (Fig. 1). Each transformer supplies half of the main bus in the board with a normally-open tie breaker between the two sections of bus. All of the breakers in this switchboard are power CB units. The mains are electrically-operated and all of the feeders can be operated either manually or electrically. The CBs have time-delay and instantaneous trip overload elements, with settings based on the amount and type of load on the circuit. Metering of energy consumption is also made in the switchboard (Fig. 2).

All power and lighting for the plant is supplied by the feeders from the outdoor switchboard. All of the feeders have the same makeup. Each feeder is a 3-phase, 3-wire circuit made up of three 500 MCM, THW insulated conductors. From the outside switchboard, all of the feeders are carried in conduit—each set of three 500s in a 3-in. conduit—underground through the adjacent wall of the building and up the inside of the wall to a giant pullbox mounted about 18 ft above the floor. The overall length of run for the feeder conduits to the pullbox is about 30 ft.

Cable Tray

At the giant pullbox inside the building wall, the cable tray distribution system originates. As shown in Fig. 3, all of the 500 MCM, THW conductors emerge from the pullbox into the trays. There are three main feeder trays which are carried from the pullbox in different directions to tie into the grid layout of subfeed and branch sections of cable tray (Fig. 4). As circuits dropped out to feed loads, the width of tray was reduced at various points. Tray widths were 24 in., 18 in. and 12 in. as required by the number of conductors to be supported (Fig. 5).

Each feeder is carried to a point in the plant where it supplies a run of plug-in busway (Fig. 6). The circuit conductors are dropped out of the tray, in conduit at each such point. The end of the conduit at the tray has an insulating bushing and is clamped to the top side of the tray. The conductors in each case are carried in the conduit to a plug-in switch which supplies the busway.

About 3000 ft of cable tray were used, at a cost of just over one dollar per ft. Here alone, the tray system offered substantial economy over the use of conduit. Because the tray sections hold a large number of feeder circuits, it would have required many times 3000 ft of conduit to do the same distribution job. And, of course, labor costs of installing just the raceway would have been many times greater if a distribution system of conduit had been used.

Less Cable Used

One of the most significant economies attributable to use of the tray system came in the amount of circuit conductors used. A 500 MCM, THW-insulated conductor has an NE Code allowable current-carrying capacity of 380 amps when not more than three such conductors are installed in conduit in an ambient of not over 30 degrees C. But this same conductor in free air, with ambient temperature up to 30 degrees C, has an NE Code current-carrying capacity of 620 amps. Although the use of THW conductors on the ladder type tray is not exactly a conductor in free air, the ventilation provided by the open construction of the tray does permit safe operation at current loads higher than the limit imposed for conductors installed in a completely-enclosing, heat-accumulating raceway such as conduit. With much greater ability to dissipate heat, the conductors in tray can carry larger currents before reaching a temperature which might damage the insulation. For this reason, the THW feeder conductors on the Savage job were carefully rated for use in the overall design. And as a result, the total demand current load of the plant is supplied by a considerably lower amount of conductors than would have been required had conduit feeders been used.

Another element of economy was contributed by the reduced labor of pulling conductors into the tray system. Installation in conduit would have been more expensive. Here, the 3-wire circuits are simply laid in the tray, with the three conductors of each circuit color coded—one red, one blue, one black—and tied together with twine about every 10 ft (Fig. 7).

Each feeder is identified by circuit number in accordance with switchgear breakers. Identification is marked in ink on paper adhesive tape wrapped around the conductors of each feeder (Fig. 8). With this system, any conductor can be removed and replaced, whenever necessary, with maximum speed and ease. Again the effect is to minimize any downtime imposed by faults in the conductors.

Loads on the individual feeders were correlated to starting currents of motors supplied and to the effects of circuit lengths on voltage drop. The longer circuits had lighter loads to keep voltage drop within limits, providing 440 volts for motors. As a result, some of the circuit breakers in the main switchboard were 400-amp units (for longer circuits), others were 800-amp units (for shorter circuits)—with trip settings to protect circuit conductors but to permit starting currents.

Equipment Grounding

Although the electrical wiring system operates ungrounded, there is a solidly bonded, interconnected equipment grounding system throughout the plant. All exposed non-current-carrying metal parts of motors, machines, busway, panels and all other electrical equipment are positively grounded.

Grounding conductors and/or conduit provide grounding of equipment to the busway system which, in turn, is bonded to the steel cable tray system through the conduit and clamp described previously. Throughout the entire length of the tray system, including all branches, sections of the tray are locked to each other with tight, solid electrical continuity and conductivity all the way back to the pullbox adjacent to the outside switchboard. And from the pullbox, ground continuity continues through the box and the incoming conduits to the outdoor switchgear ground bus.

Actual earth connection for the grounding system is made by connection to an interconnected layout of eight driven ground rods under the switchgear pad and one ground rod under each transformer pad. The net result is a highly effective grounding of all of the cable tray system and all other enclosures of electrical equipment.

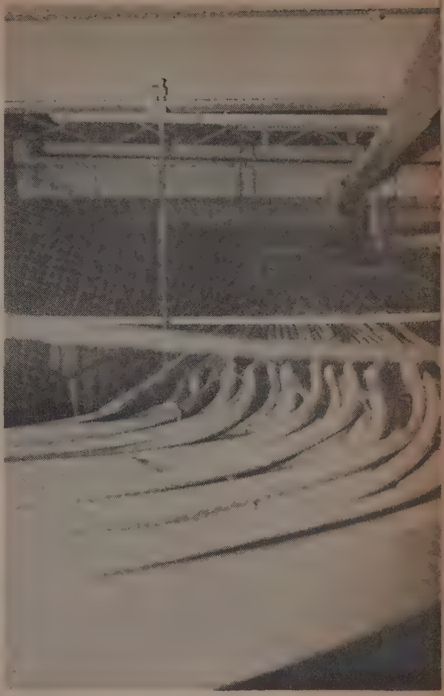


FIG. 7—Feeder circuits, each made up of three THW-insulated, 500 MCM conductors, are uniformly color coded, twined together in groups at 10-ft intervals and laid on the tray. The tray shown here is mounted about 12 ft above the floor in this particular area.

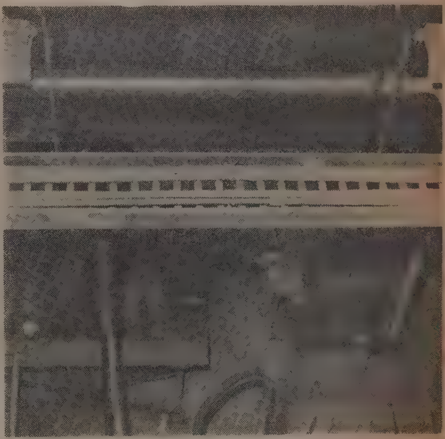


FIG. 8—Typical circuits in a subfeed section of tray are shown here, looking from above the tray. This 12-in. tray run is mounted about 8 ft above the floor of the plant. Note the twine grouping the conductors of each feeder and the label wrapped around each feeder to identify the circuit by number.

• ESTIMATING FORUM—IX

Analyze Tool Savings—Don't Guess

By **Ray Ashley,** *Research and Consulting Engineer, Oak Park, Ill.*

QUESTION: **How much will the use of a power-driven thread cutter reduce labor on an industrial electrical project?**

ANSWER: **An estimated 1% to 2% of the total job labor.**

DISCUSSION:

The portion of work performed by a power-driven thread cutter moves so rapidly that one is prone to over-rate its effect on the job as a whole. Besides, its use is limited to a small part of the conduit installation which, in turn, represents only 10% to 20% of the total job labor.

Divisions of labor for an ordinary industrial job using rigid conduit are listed in Fig. 1. Later we will see that the greatest saving in labor is on the feeder installation which represents only 11% of the total job labor. Note that Fig. 1 has about 12% of the total time assigned to bus duct. First, we will study the job as shown and then consider the effect of eliminating the bus duct item.

From an analysis of labor distribution for conduit installation (Fig. 32, page 50, Electrical Estimating, McGraw-Hill Book Co.) we find that the percentage of the total installation time required for threading varies from 18.7% (½-in. conduit) to 27% (4-in. conduit). The approximate average is 23%. The threading time for 2-in. conduit is 23.3% of the total installation time.

From the Electrical Estimating study we have the following figures:

Total Installation Time for
2-in. Conduit—100 ft.—15.0 hrs.
Cutting Time (3 cuts, including measuring) — 1.2 hrs.
Threading Time (5 threads) — 3.5 hrs.

Cutting time (1.2 hrs.) and threading time (3.5 hrs.) total 4.7 hours (use 4.8). Both the 4.8 value and the 15 hours total installation time were established by the use of power equipment. Without power equipment, the cutting and threading sum would have been 6.4 hours and the total installation time 16.6 hours (15 + 1.6).

Power equipment saved approximately 25% on cutting and threading—or 1.6 hours (6.4 − 1.6 = 4.8). This 1.6 figure represents about 9.6% of the estimated 16.6 hours total installation time. The 9.6 value will be used later.

Going back to Fig. 1, we see only two listings that can be materially benefited by the use of a power threader: Lighting Branch Wiring and Feeders. Although power branch wiring employs conduit, power threader use is limited. Here, it will be considered nil.

Although we will not go into detailed figures of Lighting Branch Wiring, some values can be stated. Of the total time for conduit and boxes, only about 4% is for threading. To allow 25% of that as a saving would be liberal. Thus, for Lighting Branch Wiring, we have 25% of 4% or a 1% saving.

We have established savings of 1% for Branch Lighting and 9.6% for Feeders. Applying these to rele-

(Continued on page 183)

FIG. 1—DIVISION OF CONTRACT
(Industrial Electrical Project)

SECTION OF WORK	DIVISION OF TIME Hours	 % of Total
Lighting Branch Wiring—Conduit and Boxes	425	30.5
Lighting Branch Wiring—Trim	96	7.0
Lighting Fixtures	160	11.5
Feeders—Conduit and Pull Boxes	150	11.0
Feeders—Wire Pulling	106	7.7
Panels and Cabinets	80	5.8
Connect to Present Switchboard	24	1.8
Power Branch Wiring	128	9.2
1000-Amp Bus Duct	172	12.0
Miscellaneous	48	3.5
Totals	1,389	100.0

Selection and application data on . . .

CBs and Contactors for High-Voltage Circuits

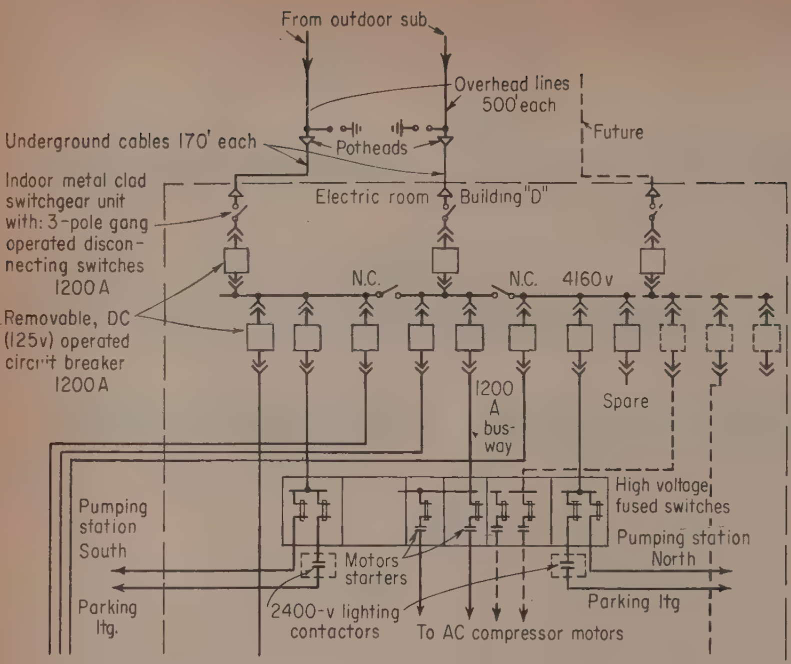
Effective design of modern high-voltage electrical systems often involves selection of circuit breakers and/or contactors for feeder disconnect and protection and for motor control. Here's a guide to proper application of both devices.

By J. P. McCauslin, *Engineer, Square D Company, Cleveland, Ohio*

IN DESIGN of high-voltage electrical systems, there are times when it may be better to use contactors for circuit-breaker applications and circuit breakers for contactor applications. In special cases, this may be justified if a complete study of the application indicates economic advantages can be obtained without sacrificing performance or preferred engineering methods. Sometimes, there is no recourse but to apply one for the other's application.

High-voltage contactors and high-voltage circuit breakers differ in many respects. One distinguishing feature is the manner in which they function. Contactors are *magnetically* held in their normal operating position. Circuit breakers are *mechanically* held. This is characteristic of both oil-immersed and air-break equipment. Although the comparisons in this article consider air-break designs only, much of the discussion applies to oil-im-

4160-VOLT STARTERS for refrigeration compressor motors consist of contactors and fused switches fed from feeder CB in main primary switchgear. Synchronous motors required special control.


From outdoor sub.
Overhead lines 500' each
Future
Underground cables 170' each
Potheads
Indoor metal clad switchgear unit with: 3-pole gang operated disconnecting switches 1200 A
Electric room
Building "D"
N.C.
N.C.
4160 v
Removable, DC (125v) operated circuit breaker 1200 A
1200 A bus-way
Spare
High voltage fused switches
Pumping station South
Pumping station North
Motors starters
Parking ltg.
Parking ltg
2400-v lighting contactors
To AC compressor motors

CB AND CONTACTOR applications are shown in this single-line diagram of the high-voltage distribution system for a large shopping center. High-voltage feeders are run from two transformers in an outdoor substation to the main 4160-volt switchgear in a basement electric room. The transformers are operating in parallel, with primaries supplied from a common 26.4 kv bus in the substation The secondary feeder from each transformer is connected to the 4160-volt bus in the switchgear through a 1200-amp disconnect switch and a 1200-amp, electrically operated main circuit breaker. The tie switches in the 4160-volt bus are normally closed, so the feeders constitute a parallel supply. Each CB in the switchgear—both the two mains and the feeder units—is a drawout-type, magnetic air-blast device in a separate unit enclosure in the complete, metal-clad switchgear assembly. The main CB units are equipped with reverse-current relays to prevent current flow from the switchboard bus into any fault which might develop in one of the 4160-volt main feeders to the building. The feeders derived from the switchboard bus supply power and light loads. One CB supplies two contactors in auxiliary switchgear, controlling ac compressor motors, with fused switches for motor disconnect and short-circuit protection. Each circuit feeds a 2250-hp synchronous motor driving a compressor. Each of the other compartments in the auxiliary switchgear contains a 3-pole, gang-operated disconnecting switch and three high-interrupting capacity fuses for each circuit. These fuses provide short-circuit protection for the circuits they supply. The operating speed of the fuses coordinates selectively with the slower operating CB units in the main switchgear. Contactors rated at 2400 volts are used to provide automatic time-switch control of parking lot lighting by turning the lighting feeders ON and OFF at prescribed times of the day.

mersed equipment designs as well.

The art of high-voltage circuit breaker design is much older than that of high-voltage contactors. High-voltage air-break contactors are relatively new and at one time, circuit breakers were the only devices available for high voltage switching, whether it was for feeder disconnects, transformer disconnects, or motor starters.

As industry expanded and large steam drives were replaced with high-voltage electric drives, it became apparent that circuit breakers were not always adequate for controlling motor applications. Oil-immersed high-voltage contactors were developed to perform more in line with motor control requirements. Oil-immersed contactors were developed first since design requirements for arc extinction were much easier to solve at that time by having the interruption under oil. As the demand grew and better materials became available, air-break contactors were developed.

Throughout the years, circuit breakers and contactors have been continually modified and improved, the manufacturers always striving for a maximum in performance and economy. As a result, both types of equipment are designed with specific characteristics for their particular application. A contactor is predominantly a motor controlling device, and a circuit breaker is predominately a circuit interrupter and protective device. The high-voltage contactors and circuit breakers marketed today are highly engineered devices, each having a definite purpose.

A few outstanding examples of one device being used for the other's application are discussed below.

A. Circuit breakers are used in place of contactors for motor starters where voltages or currents are higher than the rating of available high-voltage contactors. 5000 volts and 400 amps are maximum ratings for contactors as defined by NEMA standards. Some 6900-volt contactors have been applied for limited service. Special contactors rated above 400 amps may be encountered also.

B. Circuit breakers are used in place of contactors for motor starters where the starting duty is very infrequent. This would be in the order of a few times in months. In this case, it is desired to use equipment for motor control and branch circuit disconnecting and protection in a single device. Space and economics may be the deciding factor. This is usually an advantage only when there is a single motor-starting device required on a branch circuit.

C. Circuit breakers are used in place of contactors for motor starters when the fault kva of the power system is greater than the rating of the contactor-type starters being considered. 250 mva at 5000 volts is the top rating of contactor-type starters when using current-limiting fuses. However, starters with fault-limiting reactors may be used on systems with unlimited fault capacity. The only limitation is that of horsepower.

D. Contactors can be used in place of circuit breakers when a simple magnetic disconnect is desired. This can be practical and economical if applicable on systems having the current, voltage, and available faults within the contactor rating. Fuses or air core reactors may be used with the contactors to increase the fault rating. Transformer primary disconnects are sometimes built this way. The limitations of contactors for such applications, as discussed below, must be fully realized first.

E. Quite often an installation will

consist of a large number of feeder and transformer disconnects with only a few motor starters. It may be practical to use circuit breakers instead of contactors for the motor starters. Conversely, an installation may consist of a large number of motor starters with only a few feeder or transformer disconnects. It may be practical to use contactors instead of circuit breakers for the feeder or transformer disconnects. In both cases the substitutions are made in order to have a uniform installation with all the units having similar parts. The limitations of both devices for the specific application should be considered thoroughly before any substitutions are made. In general, the cross application of circuit breakers and contactors is not good practice. Some of the important characteristics and design features of both high voltage devices are outlined in an accompanying table. The numbers in the table indicate paragraphs below which give more details on each statement in the table.

1. A circuit breaker is usually a magnetically closed and mechanically latched device. Designs other than direct magnetic closing may be encountered such as spring or air operation. The mechanically latched design can allow power to be maintained on momentary or extended low voltages. The circuit breaker is not necessarily disconnected on power outages. This can be the intended purpose on incoming line units, feeder and transformer disconnects. In this case, resetting of the breakers is not required.

2. On motor-starter applications, the mechanically latched feature of circuit breakers is not recommended. Ordinarily motors should not be energized on low voltages, even though the overload relays would eventually protect them. On return of power after an outage, motors will start up automatically if the starting device is latched in. This is not always a desirable condition. An additional feature can be added to circuit breakers to provide undervoltage protection and have the breaker trip open. This is added mechanical or electrical equipment and cannot compare with the simplicity of a contactor.

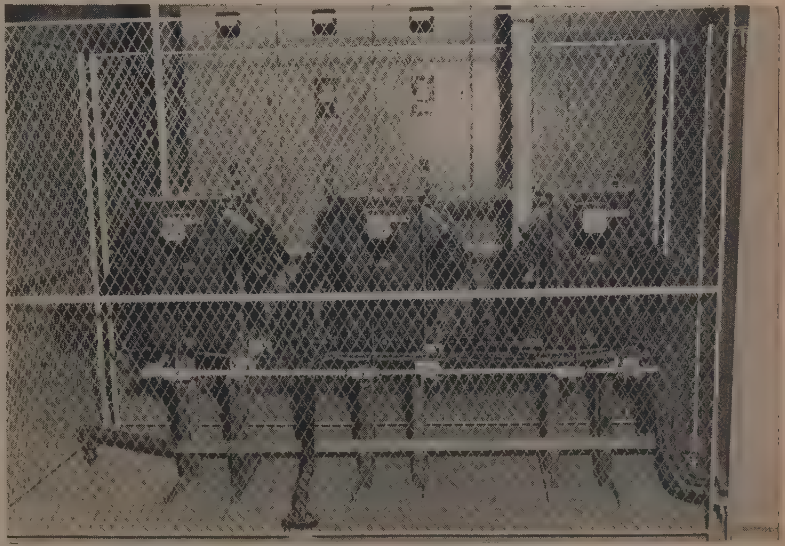
3. A contactor is normally a magnetically closed and magnetically held device. Power will be interrupted on momentary or sustained low voltages below the minimum holding voltage of the operating coil. This is the intended purpose for motor starters, to provide simple and positive low-voltage protection.

4. When a contactor is used as an incoming line circuit breaker, feeder, or transformer disconnect, a momentary or sustained low voltage could de-energize the contactor and interrupt power completely to the system. Low voltage might be preferred on a system for a while instead of a complete outage. It is possible to modify the contactor type starter electrically and provide a circuit which will keep the contactor energized to approximately 25 or 30% of normal voltage. In special cases, this feature might permit a contactor to be used as a simple magnetic disconnect in place of a more expensive circuit breaker. All the details of such an application should be analyzed to insure satisfactory performance with this substitution.

5. An air-break circuit breaker is designed primarily for infrequent circuit interruptions. It is opened and closed electrically, initiated by master switches or protective devices. The spring-loaded opening design insures operation after long periods of closure. Generally speaking, circuit breakers can be operated trouble-free for 2,000 to 15,000 times without the necessity of rebuilding—depending on the size, design, and application. This usually satisfies the needs of feeder or transformer disconnects for many years without repairs.

6. A contactor is designed primarily for frequent contact operation, in the order of a million or more times without major repairs. Many repeated operations at normal current are common for contactors without inspection or repairs. This is a necessity for motor starting or controlling applications where operations are frequent and continuity of service is important.

7. Without the spring-loaded opening design of a circuit breaker, the same positive operation might not be assured when contactors are applied on feeder or transformer disconnects that are closed for long periods of time. Contactors cannot readily be designed with high contact pressures equivalent to circuit



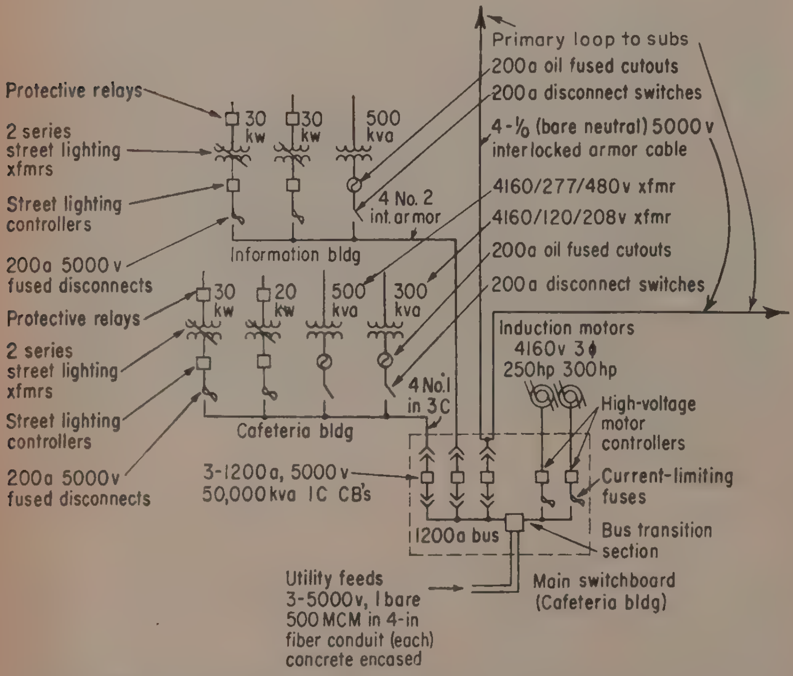
HIGH-VOLTAGE CONTACTORS used as remote control switches in outdoor lighting feeders are mounted in a bank of six—back-to-back pairs—alongside switchgear housing fuses for short-circuit protection of the lighting feeders and switches for disconnecting the fuses. Three contactors are used for each feeder—one contactor per phase. Each contactor is a magnetically operated single-phase, 2-pole, 2400-volt, 70-amp oil switch. In each, the two poles are wired in parallel to operate as a single-pole device. The control circuit for the operating coil of each contactor operates at 120 volts. The control switches for operating the contactors are mounted on a lighting control board at one end of the basement electric room. Each of the feeders for the outdoor lighting is a 3-phase, 4-wire, 4160/2400-volt circuit consisting of direct-burial cables run underground to the various lighting poles in the parking area where single-phase 2400-volt power is stepped to 120/240 volts for the lighting fixtures on top of the poles. The contactors are mounted on an angle-iron framework and are protected by an enclosing cage 6-ft high.

breakers. Also, the current-carrying ability of a contactor can be reduced when continually energized for many weeks unless special provisions are included. Copper-to-copper contacts will gradually heat and form an oxide causing further heating which becomes progressively worse when continually energized. This can destroy the contactor eventually. Alloy contact tips suitable for repeated operations or continuous duty can greatly improve this undesirable feature.

8. The mechanically latched-in-design of circuit breakers permits high contact pressures. Equivalent pressures with magnetic holding coils of contactors would not be practical. With this mechanically latched-in feature and spring-loaded-opening feature of circuit breakers, welding closed due to low contact pressure or high currents on closing is greatly reduced. The emergency opening of a branch circuit is generally assured.

9. Contactors being magnetically held devices are susceptible to welding more than circuit breakers. A low-voltage condition can result in low contact-pressure, and when large currents are flowing during the closing or the opening of a contactor, welding of the tips can occur with the contactor in the kiss position. Very high currents for short durations are common on feeder or transformer installations. The use of copper alloy or silver alloy tips as compared to plain copper or silver or silver faced tips will reduce welding of the tips considerably. Also, by incorporating a circuit modification, the same that enables a contactor to remain energized with approximately 25% or 30% rated voltage, the operation of the contactor when opening on low voltage can be made positive instead of hesitant at the kiss position to virtually eliminate welding.

10. Because of its mechanically latched-in feature, a circuit breaker requires energizing of its trip coil to de-energize the power circuit. In the terms of motor control design, this is not a fail-safe scheme. Should the trip coil fail, the circuit breaker could not be de-energized normally. This feature in circuit breaker applications is justified because fail-safe requirements are not considered in the same respect as they are in motor control. Also, the tripping coil would not be subjected to as much abuse as it would on a repeatedly operated application. For feeder and transformer disconnects, the circuit breaker as applied is more effective with the latched-in design rather than having a magnetically held fail-safe design.


Primary loop to subs
200a oil fused cutouts
200a disconnect switches
4-1/0 (bare neutral) 5000v interlocked armor cable
4160/277/480v xfmr
4160/120/208v xfmr
200a oil fused cutouts
200a disconnect switches
Protective relays
2 series street lighting xfmrs
Street lighting controllers
200a 5000v fused disconnects
30 kw
30 kw
500 kva
4 No. 2 int. armor
Information bldg
30 kw
20 kw
500 kva
300 kva
Protective relays
2 series street lighting xfmrs
Street lighting controllers
200a 5000v fused disconnects
4 No. 1 in 3C
Cafeteria bldg
Induction motors 4160v 3φ
250hp 300hp
High-voltage motor controllers
Current-limiting fuses
3-1200a, 5000v 50,000kva IC CB's
1200a bus
Bus transition section
Utility feeds 3-5000v, 1 bare 500 MCM in 4-in fiber conduit (each) concrete encased
Main switchboard (Cafeteria bldg)

TYPICAL SYSTEM for high-voltage distribution to load-center subs throughout a large motel area uses CBs and motor control contactors in the main switchboard and contactors for control of the feeds to the constant-current transformers for series street lighting luminaires.

11. Because of its magnetically held feature, a contactor can be used as a fail-safe device. Failure of the holding coil will automatically de-energize the circuit. In motor control design, fail safe is fundamental.

12. In many designs, the blowout coils on contactors are in the circuit all the time. This is not so with circuit breakers. For a continually energized application with large amounts of current flowing, the power losses attributed to the blowout coils may be high enough to be objectionable.

13. The inverse time characteristics of circuit-breaker overload components are designed to match those of branch circuit feeders and transformers as closely as possible. The overload relays are usually the induction-disc-operated type. Their settings are flexible with time-controlled tripping. Thermal damage characteristics of motors differ appreciably from those of open or enlosed cables. Overload protection of motors requires relays with thermal characteristics similar to those of motors. Thermal overload relays used with contactor-type motor starters are purposely designed to meet this requirement and may not give the desired protection for cables or transformers. It is possible to substitute the induction-disc-relay type overloads with their many variables in contactor-type starters and obtain acceptable tripping characteristics for cables or transformers. Likewise, circuit-breaker starters can have thermal relays for motor protection.

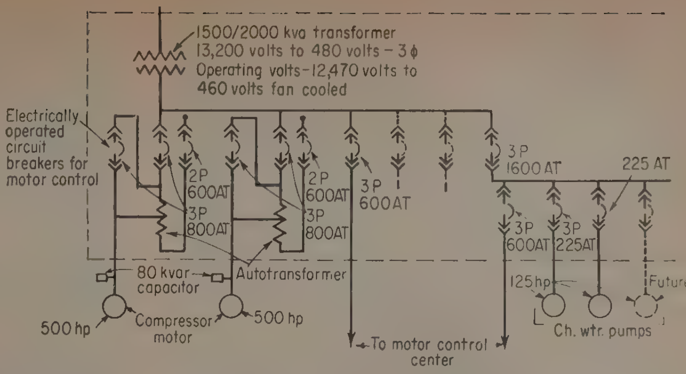
14. Most older circuit-breaker designs have longer operating times than contactors. Generally, these circuit breakers operate in the order of six to eight cycles. Some newer circuit-breaker designs have faster operating times and can compare with contactors. Contactors can operate in the order of two to three cycles. This includes overload operation and arc extinction time. For motor-starter applications, the fast operating time of a contactor during severe faults limits the equipment to less thermal and mechanical strain. Also, the use of current-limiting fuses, quite often applied with contactor-type starters and not ordinarily applied with circuit-breaker type motor starters, can appreciably limit the fault current to the motor. When

the fuse clears a fault in $\frac{1}{4}$ cycle or less, it limits the peak fault current and gives additional protection to the equipment against mechanical or electrical stresses. This is not obtained with circuit-breaker starters.

15. Since contactors can operate in two to three cycles, they may be required to interrupt a substantial portion of the decaying dc component during a fault. Circuit breakers, when operated at six to eight cycles, are not required to interrupt as much of the dc component because it will have decayed practically to zero. Fast-operating breakers will be required to interrupt some of the dc component. Contactors are rated in symmetrical kva, and this rating includes any dc component that may be present. The application of circuit breakers for interrupting ability is more complicated. The operating times and published interrupting ratings should be analyzed carefully to determine whether or not any dc component will be included.

16. Due to the importance of continued electric service and coupled with the duty limitation and complexity of circuit breaker maintenance, most feeder and transformer disconnects are designed with the circuit-breaker mechanism as a drawout replaceable unit. Very little time or effort is required to make the change and this is desirable for feeder installations. Contactor-type equipment is usually not designed with replaceable units since it is normally more sound mechanically and able to take more abuse without maintenance. Maintenance of contactors can be considerably easier than circuit breakers, and normally short down times for maintenance can be scheduled and tolerated with motor installations. Some contactor-type starters do have rollout and replaceable unit designs for maintenance of the contactor. This can be practical or impractical for motor installations, depending on the specific application and starter design.

In summing up, each device should be used as it was originally intended, circuit breakers with branch circuits, feeders and transformers; contactors with motors. There are exceptions to this and after careful consideration of all conditions by the user of manufacturer, it may be advantageous to substitute one for the other's normal application.



CIRCUIT BREAKERS may be used as motor controller when starting is done very infrequently and when other conditions of application permit the use of the single CB device to serve the functions of motor disconnect, motor controller and branch circuit overcurrent device. The NE Code permits the use of a CB as a motor starter In the above diagram of an industrial load center, power circuit breakers are used for both reduced-voltage starting and across-the-line starting. At left, two 500 hp compressor motors are controlled by autotransformer hookups of CBs to provide reduced-voltage starting of these large loads, minimizing disturbances to the system voltage. The starter for each 500-hp motor consists of electrically operated circuit breakers in a start-run circuit using a timing relay for the two-step operation. Each motor is rated at 537 amps, full load, and 2840 amps at locked rotor. Using the autotransformer, only 65% of full voltage is applied to each motor at starting. Relays control operation of the 2-pole 600-amp CB which wye connects the autotransformer windings on starting and opens them on running. One 800-amp CB is a main contactor and the second is used to short out the autotransformer on running. At right, 225-amp CBs are used for controlling 125-hp chilled water pumps.

TABULATION OF COMPARISON

High-Voltage Air-Break Circuit Breaker		High-Voltage Air-Break Contactor	
Principal Application is for Feeder and Transformer Disconnects		Principal Application is for Motor Starters	
Device is Mechanically Latched Closed		Device is Magnetically Held Closed	
More Expensive		Less Expensive	
Advantages for Feeder & Transformer Applications	Disadvantages for Many Motor Applications	Advantages for Many Motor Applications	Disadvantages for Feeder & Transformer Applications
1. Not Always Disconnected on Power Failures			4. Always Disconnected on Power Failures
	2. More Complicated Low-Voltage Protection	3. Simplest Low-Voltage Protection	
5. Spring Loaded Positive Opening			7. Less Positive Gravity Opening
	5. Designed for Infrequent Operations	6. Designed for Frequent Operations	
8. Higher Contact Pressures			9. Lower Contact Pressures
	10. Does Not Fail Safe	11. Fails Safe	
12. No Blowout Coil Power Loss			12. Blowout Coil Power Loss
	14. Usually Slower Operating	14. Faster Operating	
16. Replaceable Unit With Power Stubs			16. Most Designs are Not Replaceable Units With Power Stubs
	16. Maintenance Difficult With Replaceable Units Not Always Practical	16. Maintenance Usually Easier	

PORTION OF MAIN exhibit floor at McCormick Place shows rows of custom-built fluorescent fixtures that provide 50 footcandles at display level throughout the 320,000-sq-ft area.

TRAILER LOADS of fixtures were brought right to installation point on floor. Special slotted-angle rack on open-bed trailer cradles nine units on padded brackets; permits easy unloading.

Material Handling Ingenuity Pays Off

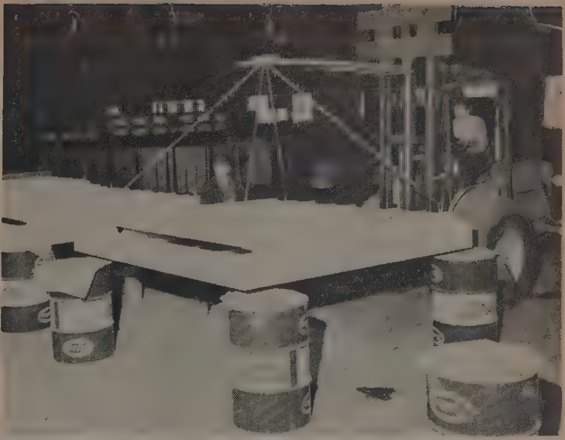
Pre-engineered, mechanized flow pattern enabled 5-man crew to hang nine 650-lb fluorescent fixtures per day, 35 ft above floor level at McCormick Place—Chicago's new exhibition hall.

By Frank W. Michal, *Fischbach, Moore & Morrissey, Inc., Chicago, Ill.*

ON ITS WAY to mounting point, custom-built, 10-ft-sq, 650-lb, Electro luminaire is carried by fork lift from lamping station to elevator hoist.

FIXTURE IS MANEUVERED into position on retracted hoist by fork-lift platform rack has slight slope to maintain proper mounting angle.

FORK LIFT unloads assembled fluorescent fixtures from trailer rack. Swivel-type, 4-point chain assembly on fork extension hooks into fixture suspension eyes.



AT LAMPING STATION fork lift deposits assembled fixture on pedestals. Here, perimeter panels were added to top; lamps and plastic louver sections were added from underneath.

VISITORS attending the opening of McCormick Place—Chicago's new lake-front exposition hall and convention center—were awed by the spaciousness and comfortable lighting of the practically windowless, 320,000-sq-ft main exhibit area. Illumination comes from rows of "luminous squares" suspended at roof-truss level throughout the area.

Each "square" is a single, 650-lb, custom-built fluorescent luminaire, 10 ft by 10 ft by 13 in. deep; contains ten 96-in., T12-VHO and two 96-in., T12-HO lamps; provides 165,000 lumens of light output; is rod-suspended from roof bar-joists. It takes 347 of these fixtures to produce a maintained intensity of 50 footcandles at display level.

Installing these king-size fixtures at a 35-ft mounting height presented an interesting challenge to Fischbach, Moore & Morrissey, Inc., project electrical contractor. Resolution of the problem began at the project estimating stage when FM&M engineers analyzed possible production line techniques. The selected program established an efficient "flow pattern" combining factory-assembled and wired luminaires, scheduled damage-proof delivery and mechanized material handling methods at the job site.

Program coordinator was Ronald Dudek, FM&M project engineer. Under his guidance this flow pattern held total installation time to approximately 50 minutes per fixture—or a truckload of nine fixtures per day with a 5-man crew. All fixtures were installed as planned and the cost was within the original estimate. And equally important, not a single luminaire was damaged and there were no accidents.

How was this accomplished? The following discussion and sequence photographs tell the story from fixture arrival to final connection.

Factory Assembly—This was a must. Shop assembly economies could not be duplicated in the field because of lack of space and assembly facilities. Fixtures were delivered completely pre-wired and assembled (except for perimeter overhang panels which were added in the field), including junction box and hanging hooks. Each fixture weighed 650 lbs.

Trailer Delivery—Two open-bed trailers solved the transportation problem and provided the key to the flow pattern and installation technique. Since fixtures were manufactured locally, a relatively short haul was involved. Each

SCISSORS HOIST raises 650-lb fixture to 35-ft mounting height in less than two minutes. Hoist motor is controlled by pushbutton stations at base and on platform.

FINAL CONNECTION to four pre-installed suspension rods and circuit drop is made by two electricians on 30-ft scaffolds rolled into place. Elapsed time from fixture unloading to final circuit connection: 50 minutes.

MOTORIZED DRIVE for hoist has pushbutton station at base and one on elevated platform for critical positioning control. This enabled electricians to ease fixtures into place without damage.

trailer was equipped with slotted-angle racks specifically designed and built to cradle nine assembled luminaires. While one was at the job being unloaded, the other was back at the factory being loaded. One truckload of fixtures was delivered each day.

Fork-Lift Unloading — Loaded trailers were brought right to the fixture hanging area on the main floor. As separator-brackets were unbolted from the racks, a standard fork-lift truck lifted the fixture clear of the cradle and deposited it on four pedestals for addition of perimeter pans, lamps and plastic louver sections. Fork extensions of 6-in. channel iron equipped with a swivel-type 4-point chain assembly provided the lifting facilities.

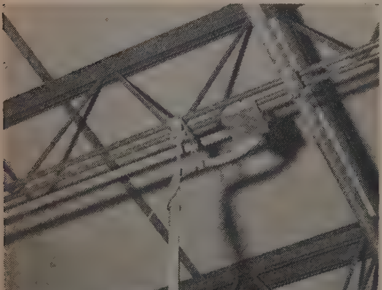
Scissors-Hoist Elevation — To raise the heavy luminaire into hanging position 35 ft above the floor, FM&M electricians used a 1,000-lb-capacity scissors hoist equipped with a 20-ft by 4-ft platform. Motorized with a 2-hp, 110-volt (for plugging into any 110-volt temporary outlet) motor, the hoist had a 20-ft per minute lifting speed. Remote control stations at the platform and base provided positive lifting control.

A fork-lift truck carried the fixture from the "lamping" station and deposited it on a special padded rack on the hoist platform. In less than two minutes, the 650-lb unit was raised into hanging position.

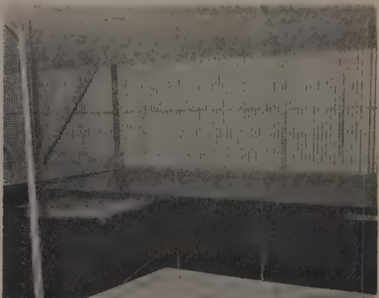
Special Hoist Rack—Except for the center (highest) row of fixtures (looking down the length of the building), each row of luminaires was installed at an angle sloping toward the building sides. Specified slope is ⅞ in. per foot of fixture, or 8.75 in. over all. A standard 5-ft high scaffold on the hoist platform had a special inclined rack to support the fixture at the proper installation angle.

Personnel Scaffolds — To keep within the weight capacity of the hoist and mostly for added personnel safety, electricians did not ride the hoist platform as it rose. Once they positioned the fixture on the hoist rack, they maneuvered two 30-ft high rolling scaffolds into position on either side of the hoist. One electrician on each scaffold fastened the fixtures to pre-set ⅜-in. hanger rods equipped with an 8-in. turnbuckle and clevis. Four rods suspend each fixture. A pre-installed conduit and cable drop with a flex jumper was connected to the fixture outlet box. All hanger rods and circuiting were installed before fixture delivery.

This installation technique was an integral part of the "flow pattern" established at the beginning of the job. Wholehearted cooperation between fixture manufacturer and contractor plus careful coordination of field crews combined to make the procedure a success.



PRE-INSTALLED RODS and branch circuit facilities were clamped to roof bar-joists. Slack steel cable is guy wire to prevent marked cross-sway of suspended fixture.



TYPICAL SUSPENSION of 650-lb luminaire on four ⅜ in. rods. Turn-buckle clevis hooks onto fixture suspension eyes. Being on an emergency circuit, this fixture has dual conduit drop.

Heat Pumps Serve A 300-Home Community

Entire Gold Medallion suburb near Sacramento, Calif., uses heat pumps exclusively for year-'round climate conditioning of 300 all-electric residences. Also included in typical modern "package" is electric water heater, range and oven, dishwasher and food disposer, clothes washer and dryer. Power distribution via 200-amp, 24-circuit, 115/230-volt installations is credited to Gray Electric.

TYPICAL ENTRANCE of Winding Way residence is flanked by ornamental bracket lantern and 2-way intercom panel (right) that permits owner to speak with callers from kitchen or master bedroom. Attractive grille work frames doorway which, at night, is silhouetted by light emanating from entry luminaire.

THE Winding Way Estates, one of several all-electric suburban communities now under construction in the Sacramento, Calif., area, is a 300-home Gold Medallion development wherein electricity, telephone and water are the only existing utility services; year-'round climate control is provided exclusively by heat pumps; and homes come "packaged" with such major electric appliances as hot water heaters, built-in range tops and wall ovens, dishwashers and food disposers, clothes washers and dryers.

Prospective homeowners are also impressed with an abundance of duplex receptacles, modern lighting and convenient switching related to some 2-dozen circuits and a 200-amp, 115/230-volt service entrance in the "typical" 5-room 2-bath residence.

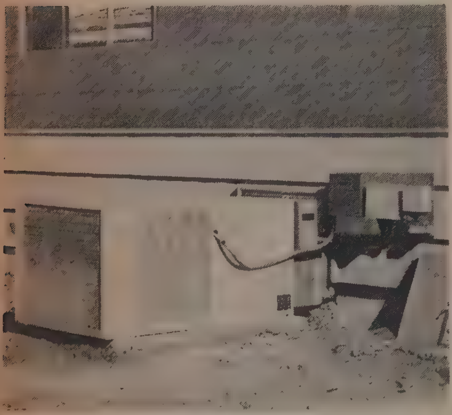
As noted in accompanying photos, indoor lighting ranges from living-room cornices and valances to recessed downlights above kitchen sinks, ranges and counter work areas; while exterior illumination is provided by photocell-activated post lamps, ornamental entrance fixtures, also spot and flood lights snugged beneath overhanging eaves of the roof.

Numerous weatherproof receptacles also provide connection facilities for ornamental garden-lighting units as well as for such "outdoor living" items as barbecue rotisseries, radios and the like.

Lighting control in these homes

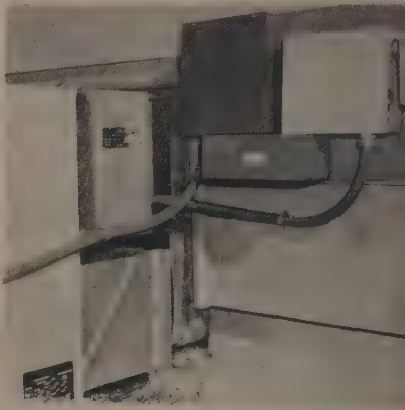
MODERN KITCHEN comes equipped with counter-top range, wall oven, dishwasher, food disposer, exhaust hood, handy counter-recessed spinner plate for powering blenders and mixers (arrow), downlights over all work areas, plus convenient duplex receptacles and silent lighting switches.

FAMILY ROOM opening off central foyer has lighted soffit that illuminates wall-to-wall wood paneling and ornamented mantle surmounting attractive open fireplace. Ceiling-recessed diffusing vents and floor-flush grille (in foyer) are related to tempered air (heated or cooled) distribution and return system.



HEAT PUMP is pad-mounted outside of house, thereby freeing additional livable space inside. Typical unit has three motors having combined full-load demand of 21½ amps, also a 16-kw, 4-stage radiant heater located inside the main duct for meeting abnormal heating requirements in extremely cold weather.

WEATHERPROOF CABINET located beneath roof overhang contains utility meter, 200-amp 2-pole 230-volt main switch and 24 circuit breakers related to single-phase circuiting. Breakers are related to heat pump, water heater, range, oven and dryer, lesser utilities, lighting and receptacles.



CONTROLS are enclosed in weatherproof cabinets located alongside heat pump for convenience of maintenance electrician, while connections between compressor, blower compartment and air-circulating ducts is effected via flexible sleeves to eliminate transmission of vibration and sound.

is via silent mercury switches, with 3-way switches providing "paths of light" in all corridors and rooms having more than a single entrance, and with split-circuit wiring of receptacle boxes providing a combination of switched and "hot" outlets in desired locations.

In this development, the Gold Medallion is a meaningful symbol denoting full compliance with recommended electrical wiring standards; the inclusion of numerous major labor-lightening appliances, plus many modern illumination ideas designed for safety, good seeing, convenience, and decorative charm.

While numerous individual heat-pump installations have been installed previously in the Sacramento area, this is the first complete residential subdivision to be so equipped; indicative of growing understanding and acceptance of this modern climate-conditioning concept by western homeowners and builders alike.

Typical pump units, for residences having 2250 sq ft of floor space, include 230-volt compressor, fan and blower motors with respective full-load ratings of 12.2, 4.9

UTILITY SERVICE is overhead along mutual easement area at rear of homesite plots. Messenger-supported reverse-lay power cables permit easy separation of conductors and mid-span splicing without cutting, while silver-grey sheathing of service leads minimizes contrast of cables against sky.

MEANINGFUL SYMBOL mounted conspicuously at each entrance is the Gold Medallion, signifying compliance with Full Housepower wiring standards. Light for living, electric heating and cooking, plus numerous additional major appliances designed to permit homeowners to Live Better Electrically.

POST LANTERN flanking front walk of this house (still under construction) is activated at dusk and dawn by photocell control, although direct manual switching is also possible when desired. Since all public utilities are installed along rear property lines, unsightly overhead wires are not obvious from streets.

and 4.4 amps; plus a 4-stage 230-volt electric duct heater, each stage rated at 4-kw.

Since extremely cold days are infrequent in this region, the pump itself is designed only for "average" cold weather, with the auxiliary resistance heaters supplying extra warmth on those few occasions when normal pump capacity is insufficient for total heating.

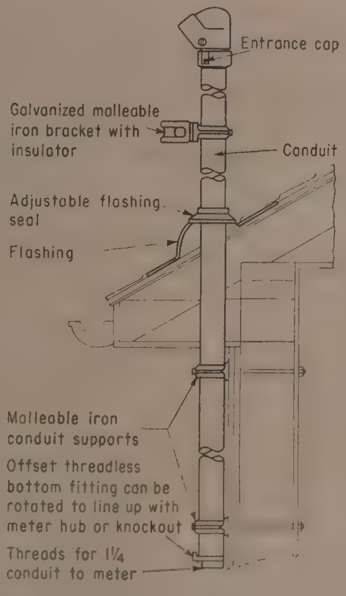
Since condenser and control equipment is pad-mounted outside the house proper, interior space allocated for heating and cooling purposes concerns only evaporating equipment. And, since power bills in these homes are averaging $13.41 a month for year-'round climate control, owners are favorably impressed with the economy as well as with cleanliness and automatic regulation of these installations.

As indicated by details noted in one of the illustrations, tempered air is circulated throughout these homes by prefabricated, insulated ducts and adjustable louvered diffusers recessed variously in walls, floors and ceilings.

Operation of heat-pump equipment accounts for four switched legs of a typical 24-breaker, 115/230-volt distribution panel; the remaining 20 positions being related to electric water heater (2), range (2), oven and dryer (4), lesser electric utilities (3), lighting and receptacle circuits (9).

Panels, with 200-amp main breakers and integrated metering facilities, are contained in weatherproof cabinets surface-mounted on exterior walls directly beneath service masts.

As noted by detailed sketch, conduit masts are pre-assembled units consisting of cap, insulated bracket for securing utility service leads, adjustable flashing for sealing conduit passage through roof overhang, conduit supports permitting bolting to building studs, plus a threadless bottom fitting which may be rotated to exactly line up mast with meter hub.


Entrance cap
Galvanized malleable iron bracket with insulator
Conduit
Adjustable flashing seal
Flashing
Malleable iron conduit supports
Offset threadless bottom fitting can be rotated to line up with meter hub or knockout
Threads for 1¼ conduit to meter

SERVICE MAST is preassembled unit with entrance cap, insulated bracket for lead-in anchoring, flashing seal, supports for attaching mast securely to frame work of residence, also an offset threadless bottom fitting which may be rotated to permit exact alignment of mast with meter hub.

Distribution of utility power throughout the community is via aerial cables located above mutual rear-lot lines that bisect each block.

With cables so located, unsightly poles and overhead cables are not obvious from streets. And, since connections between utility lines and residential service masts are via silver-grey sheathed conductors, the contrast between conductors and sky is less pronounced. It may also be mentioned that, since service taps are made at mid-span of utility lines rather than at supporting poles, overhead lead-ins are shorter, lighter in weight, more economical.

Mid-span tapping of power cables is facilitated by the reverse-lay construction of same, for individual conductors can be separated easily to permit tapping without cutting, while cable stress is minimized by supporting steel messenger cables secured at poles by anchors or deadends.

Wiring of these "Parker-Built Homes of Tomorrow" was by Gray Electric, while installation of heat pumps was by California Air Conditioning.

Humidity and Condensation—I

The first of a series exploring the good and bad effects of moisture in the electrically heated home.

By W. J. Novak

WATER, in all of its states or forms, plays an important part in the successful performance of an electric heating system. Properly controlled, it can be beneficial; neglected, it can be detrimental. The higher relative humidities usually encountered in an electrically heated structure contribute to the well-being of its occupants and the life of its furnishings. However, if it is not handled properly, resulting condensation can be responsible for difficulties ranging from simple annoyance to paint blistering, reduction of insulation effectiveness, and structural deterioration. An understanding of the factors affecting relative humidity and condensation can go far to insure the benefits and avoid the pitfalls.

The Electric Heating Forum is designed to provide a means of industry-wide communication on electric heating practices and problems.

Paramount in importance in any heating installation, both from a comfort standpoint and because of its ultimate effect on the structure, is the control of moisture and humidity. Fundamentals are presented this month; succeeding articles will discuss structural effects in detail and methods of control.

Readers are invited to express their opinions; relate their own experience data to the material presented; or submit new ideas, research data, or case studies on any aspect of electric heating. Please address correspondence to:

Electric Heating Forum
Electrical Construction and Maintenance
330 W. 42nd Street
New York 36, N. Y.

Reprints of this and previous EHF articles may be obtained at the following prices:

1 to 49 copies:	20¢ each
50 to 100 copies:	15¢ each

Also available:
- Automatic monthly mailing of quantity reprints; write for details and prices.
- An attractive, colorful 3-ring binder designed to hold a year's issue of EHF, Price, $1.00.

What is humidity? Humidity is actually another way of saying water vapor. Out-of-doors, water vapor enters the atmosphere through evaporation from oceans, lakes, and other bodies of water; by direct evaporation from the earth and its vegetation after a rainfall; by exhalation from plant surfaces; and by evaporation of small quantities of water present as a result of the many and varied facets of everyday living. Inside an electrically heated home, evaporation takes place during cooking processes, showering and bathing, clothes and dish washing and drying, floor washing, by exhalation or "transpiration" from house plants, and directly from the skin of the home's occupants.

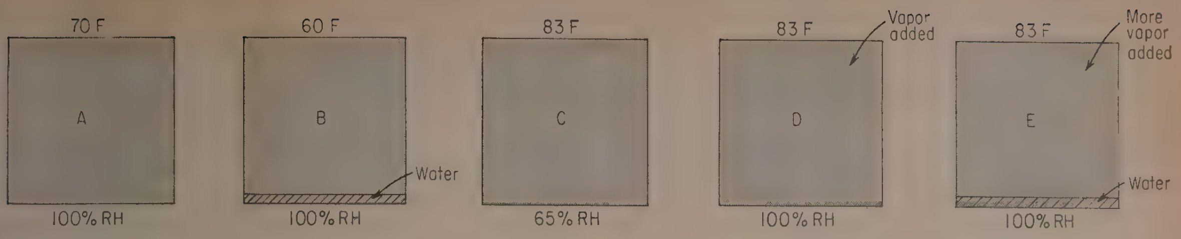
From a comfort heating standpoint, we are interested in the *amount* of water vapor present in the air in the home. At any given time, this amount depends upon (1) the quantity introduced by the above-mentioned processes; (2) the amount entering from the outside through natural infiltration or mechanical ventilation, and (3) the amount leaving by means of exhaust fans, fireplace chimney, automatic dampers, and by exfiltration through the lee side of the building structure.

The amount of vapor present in the air is expressed as a percentage of the maximum amount the air can hold at a given temperature before some of the vapor begins to condense out as water. This percentage is called *relative humidity*. Theoretically, the relative humidity can vary from 0% (dry air) to 100% (saturated air).

How is relative humidity measured? Several types of instruments are used for determining the percentage of water vapor present in the air. Accurate measurements are obtained with the sling psychrometer and aspiration psychrometer, whose wet- and dry-bulb temperature readings are used in conjunction with a "psychrometric chart" or in calculations to determine the relative humidity. For the home, satisfactory instruments are available which indicate relative humidity directly by means of a dial and pointer.

How is relative humidity affected by temperature? Note that relative humidity is a percentage of the

Temperature-Humidity Relationships



Warm air is capable of holding more water vapor without condensation than colder air.

A. Assume a given volume of air at 70F holds all the water vapor it can hold without some of it condensing out. The space is "saturated"; the relative humidity is 100%.

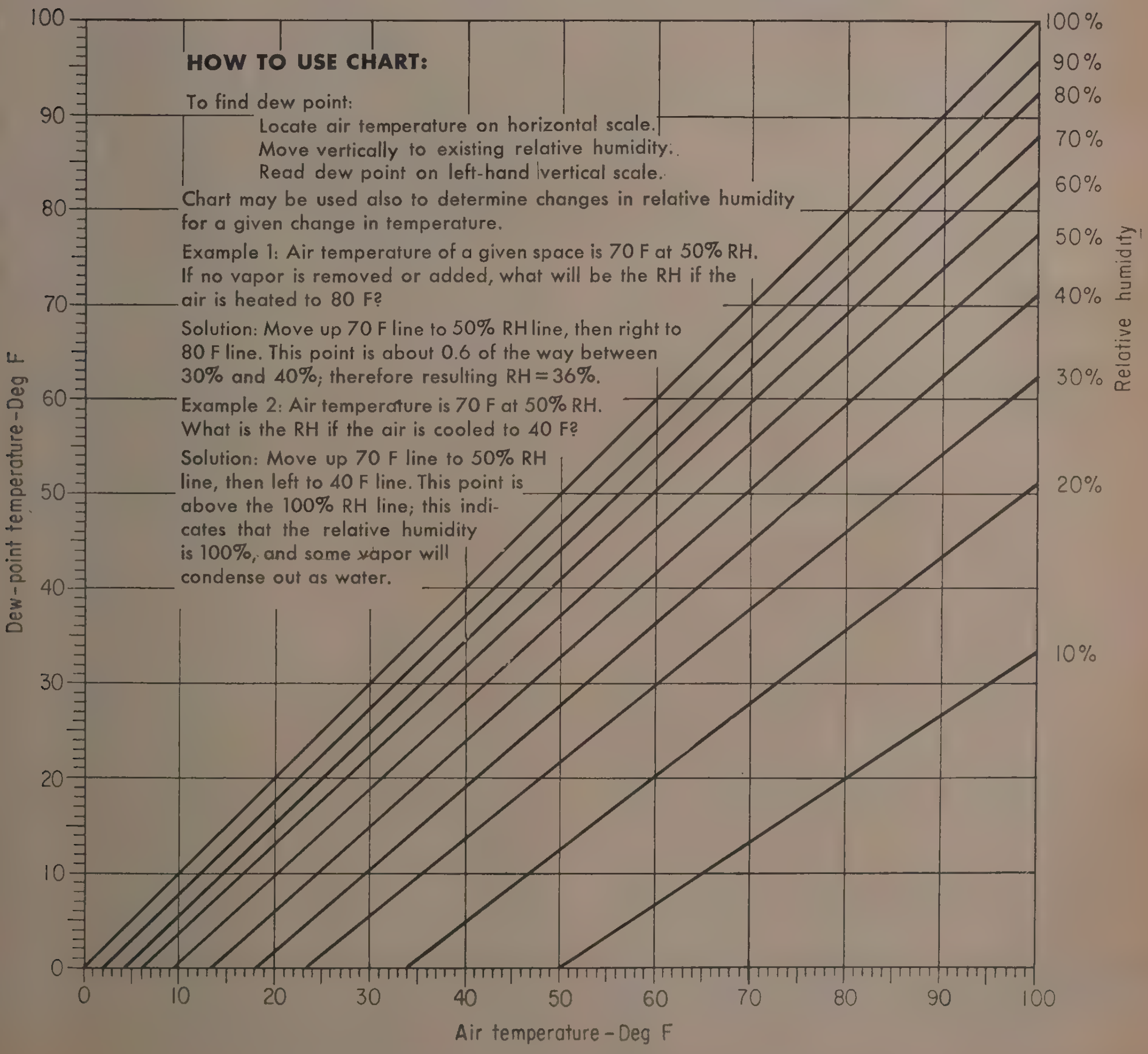
B. If the temperature is lowered, some vapor will condense. The resulting mixture is still saturated, although there will be less vapor present in the air.

C. If the temperature is now elevated beyond 70F, the water will evaporate, and the space will contain the original amount of vapor. However, the higher-temperature air is capable of holding more vapor than 70F air; therefore, the humidity will be less than 100%.

D. If additional vapor is introduced into the space, saturation will ultimately be restored.

E. Any more vapor added will cause an equal amount of vapor to condense out as water. The same amount of vapor remains in the air; the relative humidity is still 100%.

Temperature—Humidity—Dew Point Relationships



HOW TO USE CHART:

To find dew point:
Locate air temperature on horizontal scale.
Move vertically to existing relative humidity.
Read dew point on left-hand vertical scale.

Chart may be used also to determine changes in relative humidity for a given change in temperature.

Example 1: Air temperature of a given space is 70 F at 50% RH. If no vapor is removed or added, what will be the RH if the air is heated to 80 F?

Solution: Move up 70 F line to 50% RH line, then right to 80 F line. This point is about 0.6 of the way between 30% and 40%; therefore resulting RH = 36%.

Example 2: Air temperature is 70 F at 50% RH. What is the RH if the air is cooled to 40 F?

Solution: Move up 70 F line to 50% RH line, then left to 40 F line. This point is above the 100% RH line; this indicates that the relative humidity is 100%, and some vapor will condense out as water.

Effect of Infiltration on Relative Humidity

These curves show how warm indoor air is affected as colder outdoor air infiltrates through cracks around windows and doors and through the building structure itself.

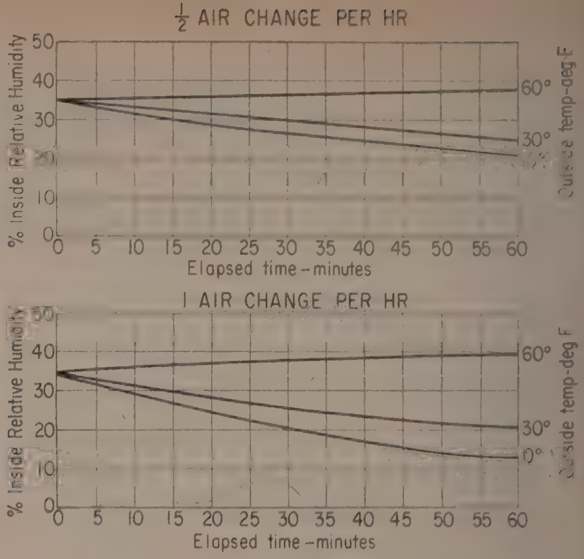
Air conditions assumed:
- Outside air: 0, 30, and 60F; 60% RH
- Inside air: 70F; 35% RH

Assumptions:
- No moisture is added or removed other than that due to infiltration.
- Outdoor temperature and relative humidity remain constant.
- Wind is at design condition: 15 mph.
- Infiltration takes place at a constant rate.

Three curves are shown for each of the two infiltration rates, each curve representing a different outdoor temperature at 60% relative humidity. Resulting indoor relative humidity was calculated at 5-minute intervals up to one hour.

At ½ air change per hour:
At 0°F outside, the inside RH will drop from 35% to a little more than 20% in one hour. At 30F outside, the inside RH will drop to a little more than 24%. At 60F outside, the outside air contains enough moisture to raise the inside RH to about 38% in one hour.

At 1 air change per hour:
The effect is more pronounced. At 0 and 30F outside, the inside RH drops to approximately 12% and 21%, respectively, while at 60F outside the inside RH rises to almost 40%.



Conclusions:
1. The tighter a house is constructed and insulated, the less effect the outside air will have on inside humidity conditions.
2. Since infiltration is affected by wind speed, lower wind speeds will have the same effect as a tighter house, producing less infiltration with a resultant smaller effect on inside relative humidity.
3. As outside temperature rises at a constant RH, it is capable of holding more moisture; therefore, it brings more moisture into the house. Eventually a temperature will be reached at which more moisture is entering the house than is leaving it, with a resulting *rise* in indoor RH. This is shown by the 60° curves.

---

maximum vapor the air can contain *at a given temperature.* Air may be compared with a sponge in this respect. The more the sponge is compressed, or squeezed, the less water it holds. If the sponge is saturated with water, the slightest pressure on the sponge will cause some of the water to drop out. Similarly, the more air is cooled, the less water vapor it can hold. If the air is saturated with vapor, the slightest drop in temperature will cause some of the vapor to condense out as moisture.

Now assume the sponge has soaked up only a small amount of water. It may be squeezed slightly without affecting the water it holds. But as the pressure is increased, eventually a point will be reached where the water will drop out. In the same way, unsaturated air (i.e., with a relative humidity less than 100%) may be cooled without causing condensation. However, as the temperature drops, a point will be reached which will cause the vapor to begin condensing out. The temperature at which this occurs is called the *dew-point temperature*, or more simply, the *dewpoint.*

As an example, suppose the air in a room is at 70F with a relative humidity of 40%. No vapor is allowed to enter or leave, and the room temperature is reduced. At 44.5F, condensation will begin. Thus, for the given conditions, 44.5F would be the dew point; and at 44.5F, the space is saturated with vapor. The relative humidity at that temperature is 100%. We see that at 44.5F the air can hold no more vapor without having it condense out. But, at 70F, the relative humidity was only 40%, which means that additional vapor could have been added at that temperature without condensation until the relative humidity reached 100%. The conclusion is that *warmer air can hold more water vapor than cooler air.* (It is assumed that the pressure is constant; i.e., atmospheric pressure prevails under all temperature conditions.)

How can the relative humidity be varied? From the above discussion, it is evident that we can change the relative humidity by (1) heating or cooling the space or (2) removing or adding water vapor to the space. Assume water is boiled on a range, for example. The vapor given off by the water will increase the amount of vapor present and thus raise the relative humidity of the space (assuming the temperature does not change). Or, allowing the temperature to drop will increase the relative humidity. On the other hand, we can lower the relative humidity by operating a dehumidifier, which removes vapor from the air, or by allowing the temperature of the room to increase. In general:

Raising the temperature lowers the RH.
Removing water vapor lowers the RH.
Lowering the temperature raises the RH.
Adding water vapor raises the RH.

Why do electrically heated houses usually have a higher relative humidity than those heated with combustible fuels? We've seen that relative humidity is decreased by removing water vapor. Any fuel-fired heating system (unless it receives direct outside air) draws air from the house to maintain the combustion process, exhausting it to the outdoors through the chimney. Thus there is a constant drain of air from the house, together with the water vapor it contains.

Eventually this would produce a vacuum condition within the house if outside air were not drawn in to take the place of the exhausted air. Together with natural infiltration caused by action of the wind, this process causes sufficient outside air to enter the house and equalize the pressure inside and out. No difficulty is usually experienced in this regard, since homes with fuel-fired systems in general are less tightly constructed and less completely insulated than are electrically heated homes.

Since we are speaking of the winter season, the air drawn in from the outside is colder than the inside air. The colder air cannot hold as much vapor as the warmer air; therefore, for a given moisture condition, the colder it is, the higher is its RH. Thus we have low-temperature, high-humidity air replacing the warm air lost both up the chimney and through exfiltration. As this cold air mixes with the existing air and is heated up to room temperature by the house heating system, its relative humidity drops drastically, often to a point lower than the existing indoor humidity level (depending upon the original condition of the outside air). Its net effect therefore is to lower the indoor relative humidity. Thus we have two factors constantly tending to lower the humidity level: the removal of warm inside air, and the ingress of cold outside air.

On the other hand, there is nothing in the operation of electric heaters which removes moisture from the ambient air. This leaves the introduction of cold outside air through natural infiltration as the only force tending to lower relative humidity. However, due to the usual tighter construction, more effective vapor barriers, heavier insulation, and lack of chimney draft to drain off warm air and cause a pressure unbalance, infiltration takes place at a much lower rate than in the fuel-fired house. Indeed, this combination of factors can cause an excessively high indoor relative humidity which must be dealt with effectively to avoid detrimental effects.

Why is a low relative humidity undesirable? Extensive research has shown that health is frequently affected more by humidity than by temperature. This is especially true where persons are already suffering from respiratory infections and other disorders. However, the healthy individual also profits from proper humidity levels. The natural layer of mucus traveling constantly from the nose toward the throat carries with it any germs deposited in the nose during breathing, which are subsequently ejected from the body by normal processes.

Under conditions of low humidity, this mucus becomes partially dehydrated. Its normal functions are impaired, permitting bacteria to remain lodged in the nasal passages, where they may incubate and develop infections. The common vaporizer used in sickrooms functions to raise the humidity level.

Low humidity levels are also evidenced by the drying out of wood and other fibrous materials used in the home. During the summer months, humidity levels are high, and all such materials have a high moisture content. When they are drained of this moisture, they tend to contract. Mitred joints in molding around doors, windows and walls separate, producing cracks. Thick layers of paint may crack and flake as a result of the contraction. In extreme cases, latches on loose-fitting doors may lack sufficient purchase to keep the doors closed. Furniture glue dries out; thin veneers separate from their base wood; book bindings crack. The many wooden linkages in a piano are affected, causing erratic action and separation of parts. The pressure of strings of musical instruments, coupled with the drying out of glue, may pull their mountings loose. And static electricity, developed in walking across rugs, for example, does not drain off into the air readily, causing irritating shocks when metal objects are touched with the hand.

What is a desirable relative humidity? Human comfort with regard to warmth cannot be specifically measured or prescribed so as to fit all individuals and living conditions. The sensation of warmth varies with the air temperature and relative humidity, air movement, radiation to cold and from warm surfaces, and the specific area of the country involved, as well as with the individual. It has been found that various combinations of temperature, humidity and

Maximum Permissible Relative Humidities to Avoid Condensation on Glass*
(70 F inside temperature; still air)

Outdoor Temperature (Deg. F)	Windows with Single Glass (U = 1.13)	Windows with Tight Storm Sash (U = 0.45)
−30	2%	40%
−20	5%	43%
−10	8%	46%
0	12%	49%
10	18%	52%
20	24%	55%
30	32%	58%
40	43%	61%
50	58%	64%
60	75%	67%

* Actual values will vary from calculated values depending upon amount of air movement past glass surface.

Example Illustrating Use of Table:

Assume an electrically heated house is located in a 0-degree outdoor design temperature area. What humidity levels can be maintained without the danger of window condensation?

The table shows that single glass would limit the permissible relative humidity to only 12%, much too low for comfort. Use of tight-fitting storm sash would extend the maximum RH to 49%, permitting normal comfort levels to be maintained.

The table shows that, to avoid window condensation at recommended 35 to 40% relative humidity, single glass is impractical in areas having an outside design temperature of 30F or below.

air movement provide the same feeling of comfort.

Practical humidity levels must take into consideration not only comfort, but also the effects on health and the house. Various temperature-humidity combinations have been found through controlled tests to be most comfortable for a majority of individuals participating in the tests. At 70F, the usual indoor design temperature, 97.7% of the people were most comfortable at 70% RH. However, 90% were also comfortable at 35% RH. (Since these tests were conducted with a central convection system with air moving 15 to 25 ft per minute, it is likely that results would differ using radiant heat.)

From a health standpoint, a relative humidity range of from 35 to 40% is generally recognized as optimum. For a person sick with a respiratory infection, from 60 to 70% RH is more realistic. This 35 to 40% range is also out of the danger zone as far as damage to interior wood finishing and furnishings is concerned. (The average wintertime relative humidity in an unhumidified fuel-heated home ranges from 10 to 15%.)

However, all these considerations must be subjugated somewhat to an evaluation of the maximum humidity level which can be tolerated from a structural standpoint. The coldest interior surface in the electrically heated home with which the heated air will come into contact is the window glass. As a practical maximum, therefore, the relative humidity should be kept below the value which will cause condensation on the windows.

Since the inside surface temperature of the glass will vary with the outside temperature, permissible maximum relative humidity will vary with the geographical location. The accompanying table gives the theoretical maximum values for various outdoor temperatures, with and without storm sash.

Next month: Effects of excessive moisture.

Mineral Wool Insulation Standards

Following up on the introduction of "R-values" to standardize product descriptions in accordance with the All-Weather Comfort Standard* for thermal insulation, the National Mineral Wool Assn., 1270 Sixth Ave., New York 20, N. Y., has prepared a **"Standard for Mineral Wool Building Insulation."**

The 7-page bulletin, available on request from NMWA, designates R-values appropriate for various standards of comfort (see table); lists standard available products; explains physical requirements, test methods, and product markings; explains how R-values are to be calculated; and defines products and product characteristics in terms of the performance demanded by the standard.

*See "All-Weather Comfort Standard," EHF No. 3, September, 1960.

Thermal Performance Standards

Comfort level	Building Section	U-value Btuh/sq ft per deg TD	Installed Resistance and Product Designation[1]
Quality home requirements[2]	Ceiling	0.05	R-19
		0.04[3]	R-24
	Wall	0.07	R-11
	Floor (over unheated space)	0.07	R-13
Moderate comfort and economy	Ceiling	0.07	R-13
	Wall	0.09	R-8
	Floor (over unheated space)	0.09	R-9
Minimum home requirements	Ceiling	0.10	R-9
	Wall	0.11	R-7
	Floor (over unheated space)	0.11	R-7

[1] Installed resistance (R) is the sum of the resistance of the mass insulation and the resistance of any adjacent air spaces or the resistance of any exposed insulation surface which may exist.

[2] Recommended by All-Weather Comfort Standard.

[3] For special situations where additional insulation is deemed necessary in ceiling.

Insulation Fundamentals Explained

A new 22-page booklet, **Insulation Fundamentals,** is available from Wood Conversion Co., First National Bank Bldg., St. Paul 1, Minn. After defining terms and discussing insulation types and performance, the booklet illustrates and explains moisture condensation and its control, heat loss, and calculations for a typical house, with an appendix giving moisture control data, thermal resistance values, and calculated U-values of insulated walls, floors and ceilings.

The material presented progresses logically from the simple basics of heat flow to analyses of heat savings through insulation, each step accompanied by a slide-film drawing, photo, diagram or table.

An additional revised brochure, **Insulating the Electrically Heated House,** is also available, relating these insulation fundamentals to electric space heating applications. Diagrams and tables give recommended maximum heat loss values.

Chicago Heating Rate Cut

New lower power rates for electric space heating were placed in effect on Nov. 25, 1960, by the Commonwealth Edison Co., Chicago.

The previous residential rate of 1.75 cents/kwhr was reduced to 1.6 cents, available to customers whose space heating facilities are exclusively electric. This is about 29% below the utility's lowest step for general household use.

Commercial, industrial and governmental customers will benefit by a rate reduction from 1.75 to 1.6 cents maximum average charge per kwhr.

At present, Commonwealth Edison has approximately 4,000 electric space heating accounts with facilities either in service or under construction.

ASHRAE Electric Heat Committee

The American Society of Heating, Refrigerating, and Air-Conditioning Engineers has organized a committee on electric heating. Members include G. G. Freyder, Commonwealth Edison Co., Chicago (chairman); E. R. Ambrose, American Electric Power Service Corp., New York; J. S. Astin, Wesix Electric Heater Co., San Francisco; R. L. Boyd, Edwin L. Wiegand Co., Pittsburgh; G. A. Erickson, Wood Conversion Co., St. Paul; Thomas Baker, E. H. Lambert Co., New York; Lowell Mast, Electromode, Rochester.

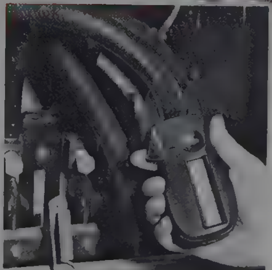
ONLY ONE SNAP-AROUND TESTS ALL THREE!

AMPROBE RS-3

THE AMPROBE RS-3 is the *only* pocket-sized, snap-around test instrument that measures voltage, amperage *and* resistance. Designed for one-hand operation, the RS-3 accurately locates opens and shorts, sets overload relays, balances loads, determines low or high-voltage conditions...in fact, it handles up to 99% of *all* your test needs!

The rugged, lightweight AMPROBE RS-3 meets every commercial voltage requirement on three voltage scales: 0-150/300/600 volts AC. It also has five current ranges from 0 to 300 amps, and a resistance scale with a mid-range reading of 25 ohms. You take these readings from a *rotary* scale...it reveals only one range at a time to increase reading speed, minimize chance of error. The RS-3 comes complete with test leads, ohmmeter attachment, genuine cowhide leather carrying case, and a *one-year guarantee* against defects in parts or workmanship. See your distributor or write today for more details.

only $52.50



AS AN AMMETER: snapped around conductors to balance circuits.

AS AN OHMMETER: check resistanc of motor control solenoid coil.

AS A VOLTMETER (large photo): check voltage on slipring of motor.

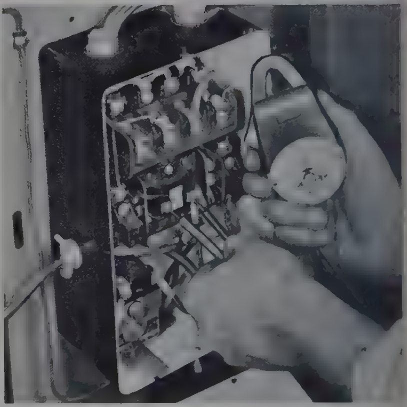
PYRAMID INSTRUMENT CORPORATION, LYNBROOK, NEW YORK *Canada: Atlas Radio Corp., 50 Wingold Ave., Toronto, Ont.*

ONLY ONE VOLTAGE TESTER MEASURES CURRENT!

AMPROBE JR.

WHY SETTLE for an ordinary voltage tester when the AMPROBE JR. gives you so much more. AMPROBE JR. is a *precision* instrument that measures voltage instantly and accurately on a calibrated scale (not just an "indication"). You can measure *amperage* as well—and *without* interrupting service! Pick the rugged, inexpensive AMPROBE JR. *you* need from a complete line of seven models: from 0-10 amps to 0-100 amps; either 0-125/150 volts AC or 0-150/600 volts AC. See your distributor or write today for more information. **only $\$19^{85}$**

ASK YOURSELF THESE QUESTIONS ABOUT VOLTAGE TESTERS	The Amprobe Junior	Ordinary voltage tester
Does it measure current as well as voltage?	YES	NO
Does it give you full visibility on a graduated reading scale?	YES	NO
Does it fit conveniently in your pocket?	YES	YES
Does it measure within ±3% accuracy?	YES	NO
Does it come in a full line of models to meet different problems?	YES	NO
Does it protect you against shorts and shocks?	YES	YES
Does it balance loads, locate grounds, determine motor overloads, check rating of circuit breakers?	YES	NO



AS A VOLTAGE TESTER: for checking critical operating voltages.

AS AN AMMETER (large photo): reading current at switch box.

PYRAMID INSTRUMENT CORPORATION, LYNBROOK, NEW YORK *Canada: Atlas Radio Corp., 50 Wingold Ave., Toronto, Ont.*

Pulling Machine for Transmission Lines

Here's the construction and operating details of a hydraulic-powered, three-conductor pulling machine designed and built by Emerson-Garden Electric Co., Inc., electrical contractors, Elizabeth, N. J.

A PULLING machine, believed to be the long-sought answer to the problem of pulling transmission line conductors, has been designed and built by Emerson-Garden Electric Co., Inc., one of the country's large electrical contractors. This machine operates under positive control at a constant, pre-determined speed and a constant, pre-determined tension, which will not vary regardless of how much or how little conductor cable may be on the reels.

The problems associated with high-voltage tower work prompted design of this unique three-conductor pulling machine. These problems included the beginning of stringing and the pulling in of bundled conductors, consisting of two conductors per phase, under simultaneous and uniform tension. In addition, because present steel towers are of such a design that they will not stand with only one outside conductor in place, it is necessary to pull all three phases simultaneously.

The greatly increased conductor lengths per reel and the operation of modern pulling machines have also become factors to be considered:

Practically all of today's pulling machines are mechanical in both the drive and braking mechanisms. Their mechanisms usually are jerky in operation and, because of the varying loading of reels, the pulling speeds are frequently changing. In addition, the friction brakes become impossible to hold at an exact tension and require constant attention to hold the conductors under proper sag.

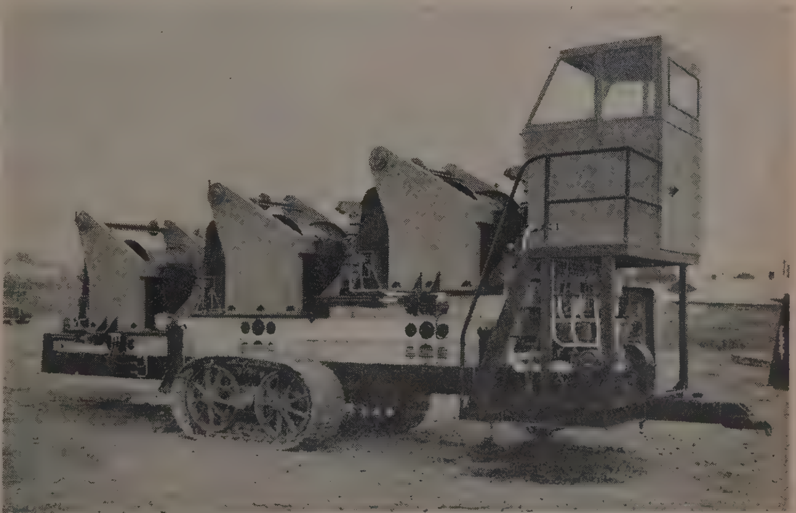
As to increased conductor lengths, the normal reel used to be approximately 3000 to 6000 ft with a single conductor per phase. Now a contractor must pull two conductors with a total reel length of upwards of 10,000 ft; and since three phases, consisting of six conductors, must be pulled simultaneously, the 3-wire pulling machine was deemed an absolute necessity in order to pull two conductors with each pulling wire.

The Emerson-Garden machine, mechanical-wise, is designed with an independent puller for each pulling cable. This cable is in turn stored on a demountable reel, having a level-winding device. The reels are capable of storing 16,000 ft of half-inch diameter steel cable. When the reels are full from a previous pull, they can be removed from the machine and sent ahead to be restrung for the next pull. An empty spool is then put in the machine and the operation is repeated.

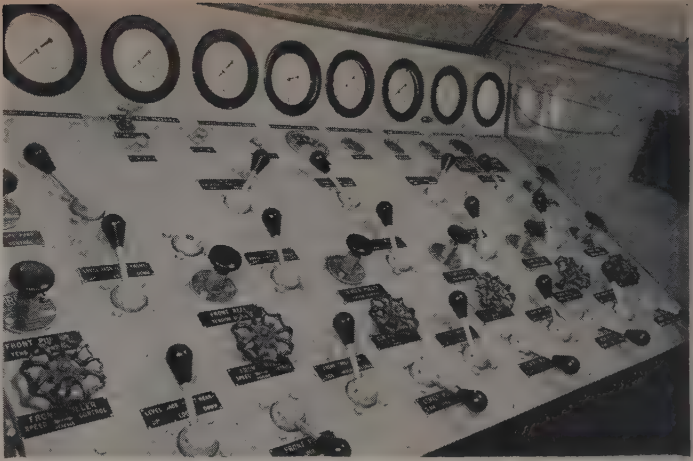
Pulling forces range from 1,000 to 10,000 lbs and speeds from approximately 100 ft to 13,000 ft per hour, with both the pulling force and the pulling speed infinitely variable. Specifications also call for the machine to work either pulling or slackening under the same conditions. It was found that in order to comply with these specifications it was necessary to use a slow-speed, high-torque radial hydraulic motor. This motor, because of its inherent characteristics, can be coupled directly to the pulling device without gears and reducers. Speed control is accomplished at the panelboard through flow control valves. The amount of pull or force developed is also controlled at the panelboard through pressure reducing valves. The pressure is remotely controlled.

Specifications on the storage reel for the pulling cable are similar to those of the puller with the exception that the amount of force required to wind the cable on the reel, while variable, is not as great as that of the puller.

Here again the operator has complete control of the speed and pressure at which the storage reel op-



GIANT PULLING MACHINE is equipped with three, separate, powered cable pullers and a separately powered storage reel for each of the pulling cables. A single man operates the machine from the cab at right. Note the hydraulic powered leveling legs under the machine.



CONTROL PANEL in the cab of the machine consists of properly identified valves for hydraulic operations, meters for pressure and temperature indications and controls for the 256-bhp gasoline engine driving the rig.

erates. All these controls are at the control panel.

The prime mover for the pulling machine consists of an internal-combustion gasoline engine with a rating of 256 brake horsepower. This prime mover is in turn connected to the hydraulic pumps by a 6-in. link-belt silent chain drive. The hydraulic pumps, driven by the prime mover, consist of one double high-pressure pump capable of 140 gals per minute oil flow at a maximum of 2,000 lbs per square inch and one low-pressure pump with a capacity of 110 gals per minute oil flow at 1,000 lbs per square inch. The former pump supplies the motivating force for the radial hydraulic motors on the pulling device and also supplies the energy for all hydraulic cylinders and winches on the machine that are in use when the pullers are not operating. The latter pump supplies the motivation for the hydraulic motor driving the storage reel for the pulling cable.

The pulling machine is mounted on a wagon chassis and is moved in trailer fashion. Another feature is the provision of hydraulic jacks that can lift the entire unit about 18 in. off the ground. Their main function is to level the machine when it is in operation or being transported on a trailer.

On either side of the pulling machine are hydraulic winches which are used to anchor the machine when it is under severe pulling conditions. The front and rear pulling assemblies can be rotated hydraulically right or left of center some 20 degrees, in order to line up the assembly with the outside phases of the tower, thus reducing the angle on the pulling cable. Once in the position selected, these units can be locked with the automatic hydraulic puller lock attachment.

All three pulling devices are equipped with a spring-loaded hydraulic cylinder which, under normal operation, is kept retracted by hydraulic pressure. If a high pressure hydraulic line should rupture or break anywhere on the machine, these cylinders will move in, locking the machine completely, thus avoiding any chance of dropping conductors which might be under pulling or tension at the time of pressure failure.

All these operations are handled from the control cab. It is not necessary at any time for any person to be on the machine except for the operator, who is in the control cab out of any danger.

Each pulling-cable storage reel is equipped with a level-winding device in order to keep the stored cable from becoming damaged by piling up on the reels. Safety devices have been incorporated on the control panel in the cab to protect the prime mover and the hydraulic system in case of low oil or excessive temperature.

Due to the nature of the pulling device and the low-powered storage reel, a 300% to 400% longer life for the pulling cable is anticipated over previous methods of performing this work.

Through the control equipment on this machine, there will be no jerking in the pulling operation, thus eliminating the chance of swaying of conductors as they are being pulled through.

. . . and for

NEARBY SERVICE on Black & Decker tools. Black & Decker maintains 50 factory service branches plus authorized service stations to give your B&D tools the attention mechanical products need periodically. Keep your B&D tools in top condition, on the job all the time.

Only factory parts and factory-approved methods are used. Fast service and reasonable cost, always.

SWIFTY SERVICE says be sure to ask about:

FREE TOOL INSPECTION no cost, no obligation.

STANDARD B&D GUARANTEE after completion of all recommended repair work.

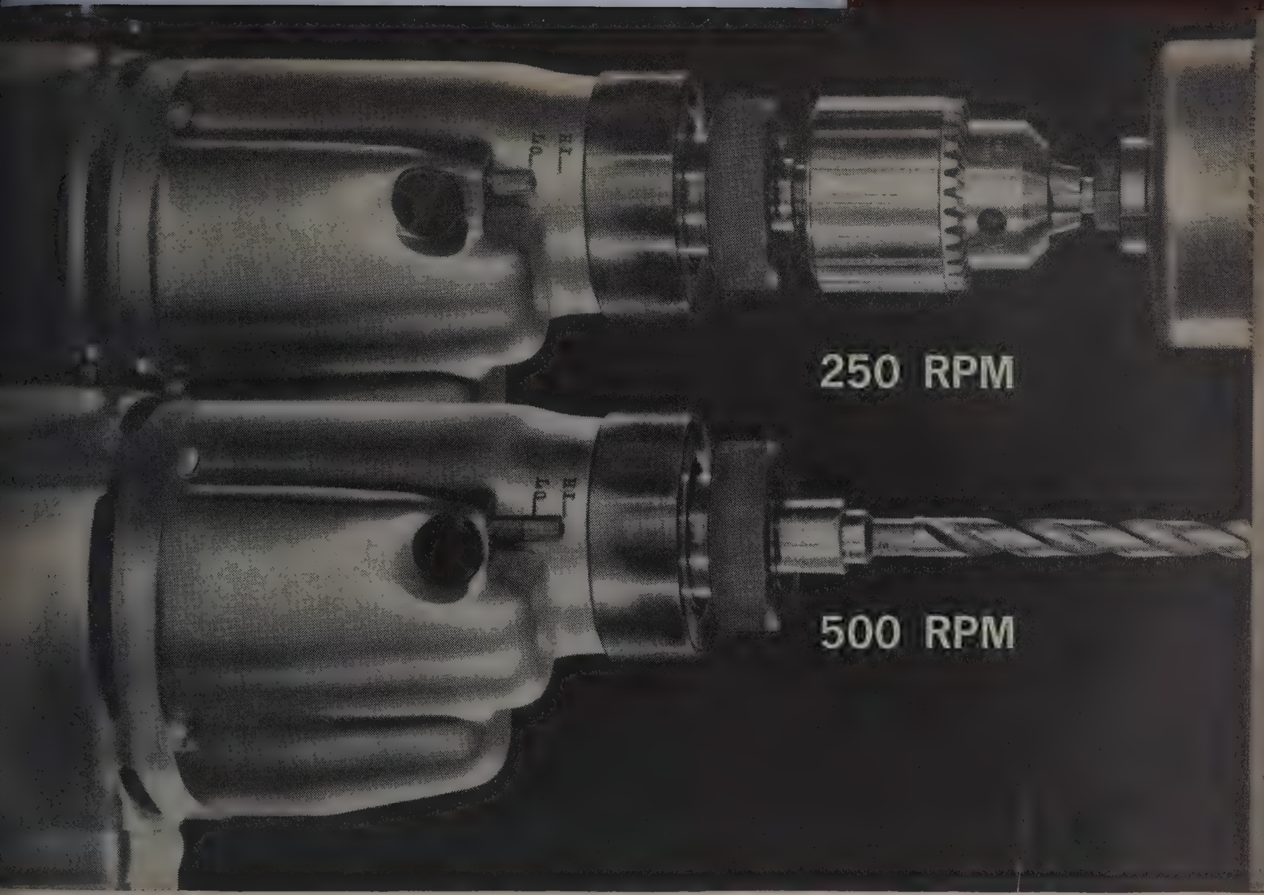
You'll find the location of the nearest B&D repair facility in the Yellow Pages under "Tools-Electric," or write for address to:
THE BLACK & DECKER MFG. CO.,
Dept. 1202-S, Towson 4, Md.

50th YEAR

See Tools-Electric -Yellow Pages- for Service & Sales

Black & Decker

Quality Tool Service



NEW 2-Speed drill has the versatility to do more jobs more efficiently!

Hole sawing . . . masonry work . . . core drilling . . . reaming . . . *any* production drilling job is a cinch with B&D's new precision-balanced Two-Speed Drill. Celebrated B&D engineering even allows you to use this ruggedly built tool as a *separate* power unit. Switch the clutch control and it automatically changes from 500 RPM for high-speed work to 250 RPM for extra-power drilling. Reverses easily too!

You'll appreciate the way B&D reserve power flows out over the heavy-duty roller bearings to give you the *precise* speed for effortless production work . . . the way work speeds through your shop, dramatically reducing your labor and down-time costs. See how B&D's Two-Speed Drill can do your jobs faster, with *less* fatigue . . . with *more* profit! Sold by leading distributors everywhere. *For sales or service look in the Yellow Pages under* TOOLS ELECTRIC

Black & Decker®

CUTS MAN-HOURS TO MINUTES

NEW Two-Speed Black & Decker Magnetic Drill Press

equipped with the new 1¼″ Two-Speed unit operates manually or by exclusive remote control. Work against the ceiling, right side up, or sideways. Gets into tight spots easily, rapidly. Also ¾″ (single speed) model.

The Black & Decker Mfg. Co., Dept. 1202
Towson 4, Md. (In Canada: Brockville, Ont.)

☐ Please arrange for a demonstration of__________

☐ Please send me more information on__________

Name____________________Title__________

Company______________________________

Address______________________________

City____________________Zone____State________

☐ IMPACT WRENCHES ☐ HAMMERS ☐ SANDERS ☐ SAWS

For "fishing" conduit...

WHY USE METAL TAPES?
JET LINE
RIGID ROPE
Replaces Fish Tape
USE IN ANY SIZE, ANY TYPE CONDUIT
JET LINE PRODUCTS, INCORPORATED

JET LINE®
NON-CONDUCTIVE
RIGID ROPE*
make metal fish tape obsolete!

NOW — with RIGID ROPE — you can fish any type conduit faster, safer, for less cost!

- Non-conductor — all polyethylene, braided jacket over solid core.
- Flexible, easy to push, glides smoothly through conduit.
- Affords excellent grip, won't "spring" out of hand, never cuts.
- Durable, long-lasting, rugged — can't rust or mildew, won't separate.
- Lightweight—50 ft. length weighs just 14 oz.
- Available in 50′ and 100′ lengths — RIGID ROPE costs less than any fish tape designed for use in all types of conduit.

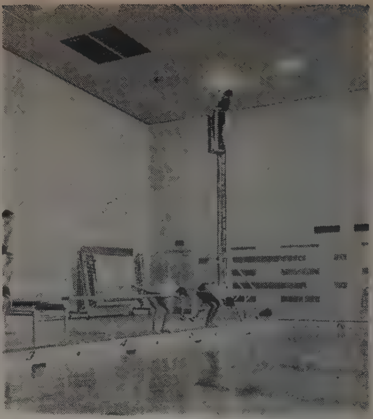
("Guide Sleeve" of polyethylene, 12″ length, included—for use in feeding Jet Line RIGID ROPE into outlet boxes.)

**Pat. Pending*

For full information on RIGID ROPE, and the complete Jet Line Method of wiring conduits, ask your distributor or write

JET LINE® PRODUCTS INC.
615 FUGATE AVENUE, CHARLOTTE 5, N. C.

5467



ALUMINUM TOWER may be rolled through doorway in collapsible position, then quickly erected to reach high, otherwise inaccessible light fixtures, as indicated in this pool-side view.

Work Platform Reduces Maintenance Costs

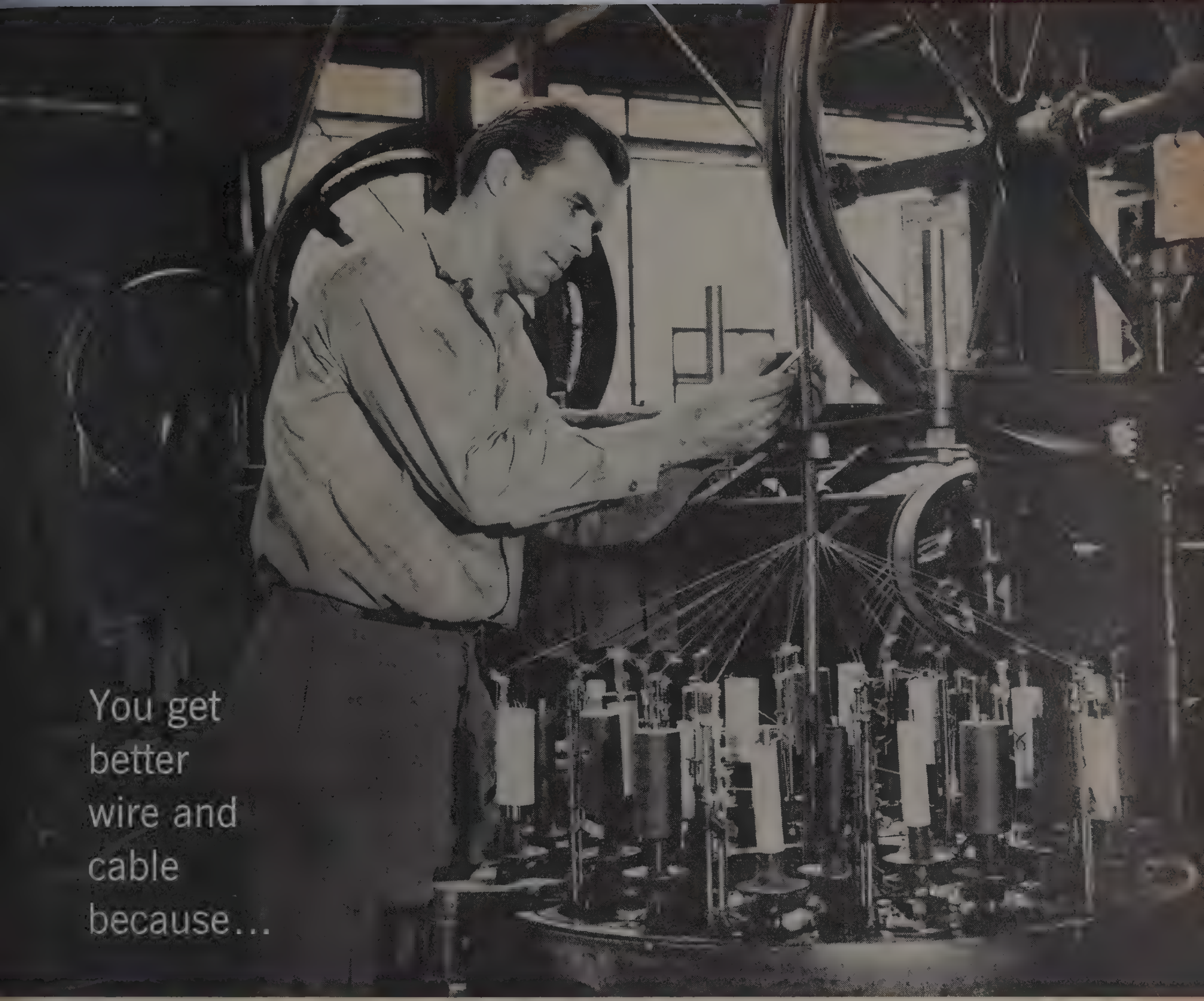
Replacing burnt-out lamps, located in inaccessible fixtures on a one-at-a-time basis, can be a costly chore; a fact which is emphasized by a case study of Northern High School, Pontiac, Mich., where overhead light bulb replacement formerly cost as much as $8.00 per lamp in labor, when using extension ladders that had to be steadied by a second man while the partner was working aloft. Now, however, by using a sturdy telescoping aluminum work platform, that can be erected by a single man, this labor charge has been reduced by half.

When folded down to pass through doorways, the lightweight tower can be rolled into gymnasium and indoor-swimming-pool areas, then quickly extended to reach high-bay fixtures. The tower can also be mounted on the back of a pickup truck for reaching floodlights mounted 25 to 30 ft above ground in parking areas. The tower, called a Tallescope, is likewise pressed into service for repainting and reroping flag poles around the premises of this school.

Plastic Conduit Speeds Underground Installation

A recent installation in Peoria, Ill., typifies one of the many new applications of plastic conduit.

To distribute power for the lighting of a super highway cloverleaf, the J. C. Schaffer Company, electrical contractors, selected 2-in. underground plastic conduit. Schaffer in-


You get better wire and cable because...

NEARLY EVERYONE AT CIRCLE'S AN "INSPECTOR"

Take Oscar Stangoni, braiding machine operator at Circle.

Mr. Stangoni doesn't need to use a micrometer. Ordinarily, his foreman sets up the machine, checks with a "mike" at the beginning of a run and several times during a run to make sure that the O.D. is OK.

But Oscar Stangoni uses one just the same—and he uses it often. Why? Maybe pride or a sense of responsibility—or maybe just because he feels better when he also knows the cable is absolutely right.

This is just one of many ways in which Oscar Stangoni and hundreds more like him at Circle make sure that the wire and cable they turn out is as good as it can possibly be.

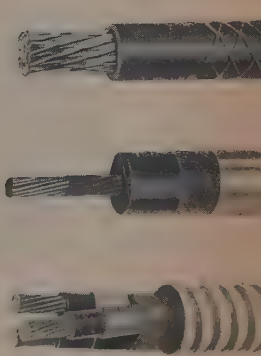
And that's another reason, we believe, why Circle products have achieved their reputation for quality.

Next time you specify cable, we suggest you ask for Circle. There's no finer cable made. CIRCLE WIRE & CABLE CORP., Maspeth, N. Y.

CIRCLE WIRE & CABLE CORP.

SUBSIDIARY OF **CERRO CORPORATION**

RUBBER COVERED WIRE & CABLE • VARNISHED CAMBRIC CABLE • PLASTIC INSULATED CABLE • NEOPRENE SHEATHED CABLE • CIRTUBE* EMT



anchor anything to any kind of masonry with

RAWL PRODUCTS

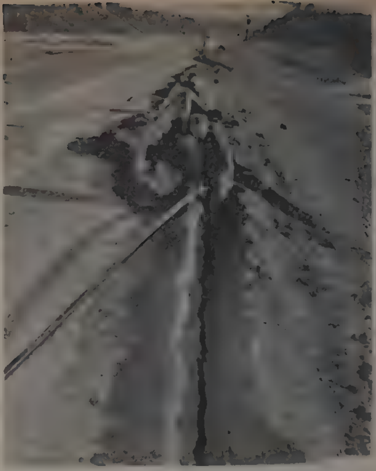
Anchoring and drilling devices for fastening anything to masonry include RAWLPLUG universal masonry anchors . . . SABER-TOOTH self-drilling anchors . . . plus a full line of other MASONRY ANCHORS, DRILLS, and ACCESSORIES . . . all in **free** 48-page pocket-size "Masonry Anchoring Handbook." Ask your supplier or local Rawlplug branch or send coupon to:

R-15

The RAWLPLUG Company, Inc.
212 Petersville Road, New Rochelle, N. Y.

I'd like a FREE copy of the "Masonry Anchoring Handbook."

Name ....
Title ....
Company... ....
Address ....



PLASTIC CONDUIT is installed in 30-ft lengths, assembled above the trench, and lowered into place later. Joints are made with a solvent weld.

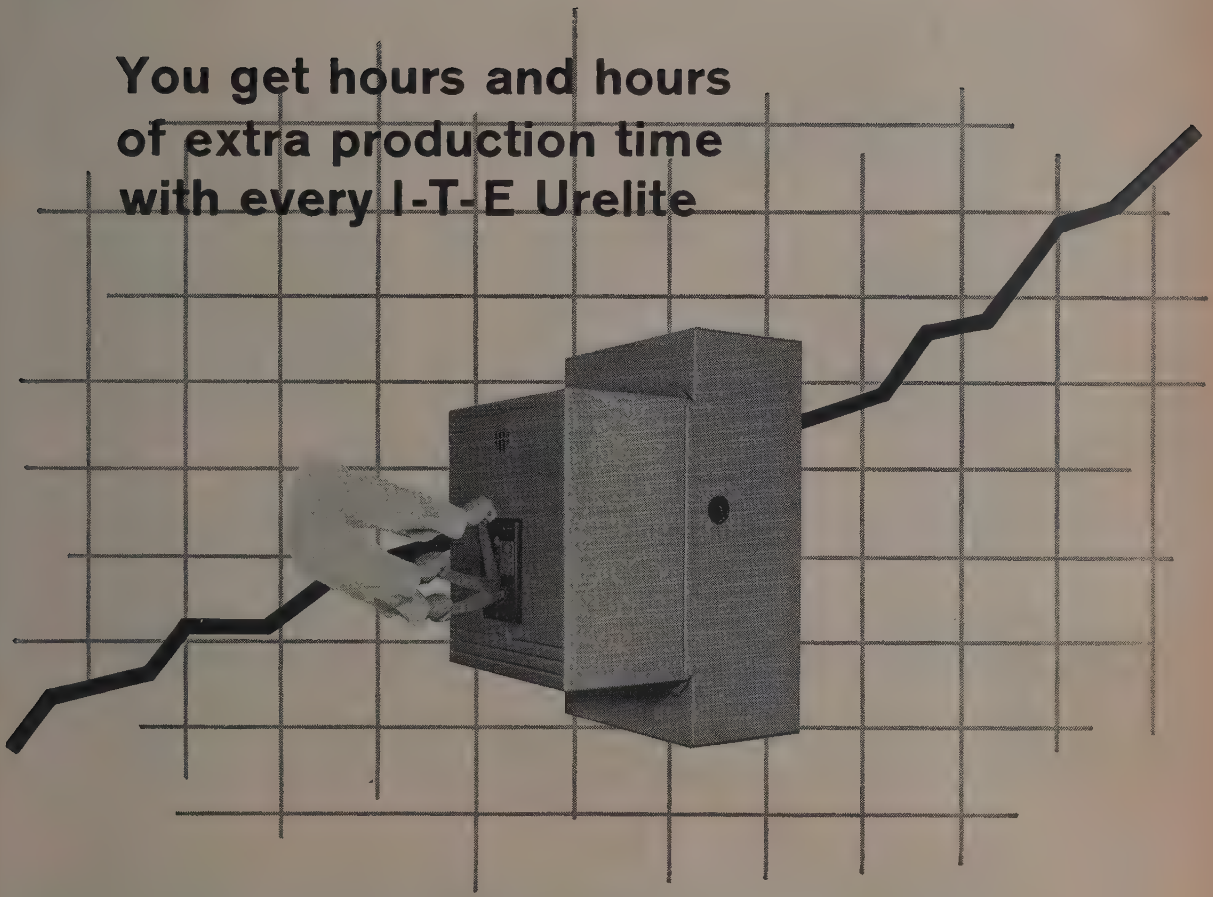
BENDS ARE STOCK FITTINGS used to bring conduit runs to the surface and are installed without special tooling

stalled over 3,000 ft of this plastic conduit anticipating labor-saving and money-saving advantages. For example, plastic conduit comes in 30-ft lengths, yet one man can easily handle three to four sections. And joints are made watertight with a quick, simple, solvent weld. Because of this and due to the plastic's flexibility, conduit runs are assembled above the trench. Assembled runs are then lowered into place. Since no work in the trench is required, the width of the trench is substantially reduced, resulting in lower excavation and backfill costs.

Another advantage gained when using underground plastic conduit, is ease of termination. Ninety-degree large-radius elbows bring conduit runs to the lamp-post base easily without special tooling or assembling.

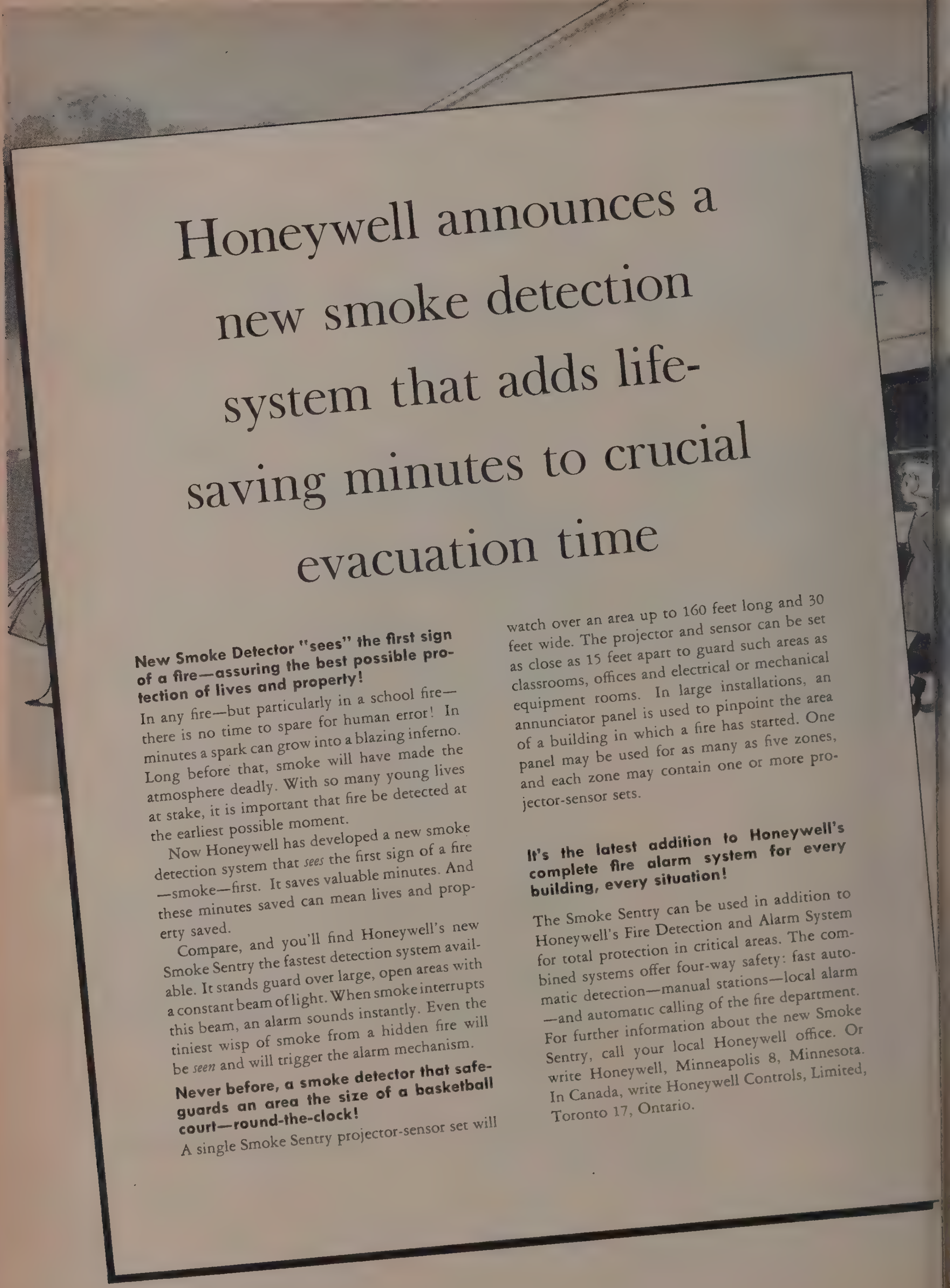
Plastic conduit is said to resist all forms of corrosion from soils, alkalis and other chemicals. And it reduces the danger of cutting cables with roadside stakes.

You get hours and hours of extra production time with every I-T-E Urelite



Urelite® is the individually enclosed power circuit breaker that can be installed anywhere. If you have a power interruption, pull the Urelite handle. Presto! you have power back. No waiting for a plant electrician to service a switch. Only the I-T-E Urelite has so many extra conveniences for easy installation, easy operation, and easy upkeep. Up to 4000 amp continuous, 150,000 amp interrupting. Big cable area facilitates installation. Drawout construction. Visible break provided through inspection windows at sides. For Bulletin 4261-2B, write I-T-E Circuit Breaker Company, Dept. SW, 1900 Hamilton St., Philadelphia 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY



Honeywell announces a new smoke detection system that adds life-saving minutes to crucial evacuation time

New Smoke Detector "sees" the first sign of a fire—assuring the best possible protection of lives and property!

In any fire—but particularly in a school fire—there is no time to spare for human error! In minutes a spark can grow into a blazing inferno. Long before that, smoke will have made the atmosphere deadly. With so many young lives at stake, it is important that fire be detected at the earliest possible moment.

Now Honeywell has developed a new smoke detection system that *sees* the first sign of a fire—smoke—first. It saves valuable minutes. And these minutes saved can mean lives and property saved.

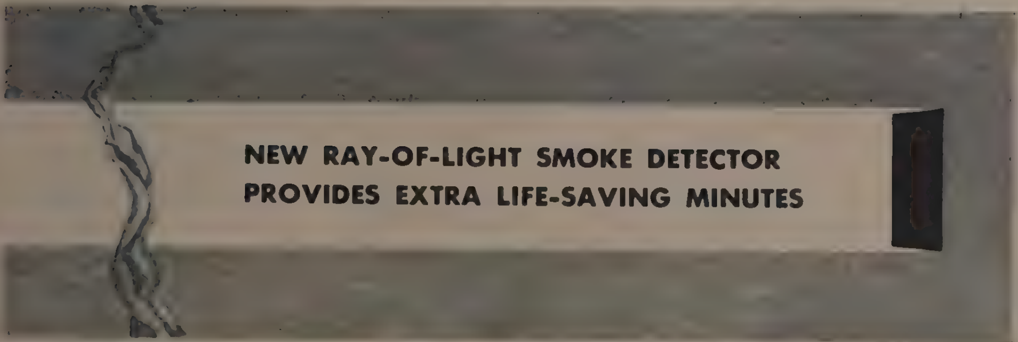
Compare, and you'll find Honeywell's new Smoke Sentry the fastest detection system available. It stands guard over large, open areas with a constant beam of light. When smoke interrupts this beam, an alarm sounds instantly. Even the tiniest wisp of smoke from a hidden fire will be *seen* and will trigger the alarm mechanism.

Never before, a smoke detector that safeguards an area the size of a basketball court—round-the-clock!

A single Smoke Sentry projector-sensor set will watch over an area up to 160 feet long and 30 feet wide. The projector and sensor can be set as close as 15 feet apart to guard such areas as classrooms, offices and electrical or mechanical equipment rooms. In large installations, an annunciator panel is used to pinpoint the area of a building in which a fire has started. One panel may be used for as many as five zones, and each zone may contain one or more projector-sensor sets.

It's the latest addition to Honeywell's complete fire alarm system for every building, every situation!

The Smoke Sentry can be used in addition to Honeywell's Fire Detection and Alarm System for total protection in critical areas. The combined systems offer four-way safety: fast automatic detection—manual stations—local alarm—and automatic calling of the fire department. For further information about the new Smoke Sentry, call your local Honeywell office. Or write Honeywell, Minneapolis 8, Minnesota. In Canada, write Honeywell Controls, Limited, Toronto 17, Ontario.



NEW RAY-OF-LIGHT SMOKE DETECTOR
PROVIDES EXTRA LIFE-SAVING MINUTES

Honeywell

First in Control

H HONEYWELL SINCE 1885

HONEYWELL INTERNATIONAL
Sales and service offices in all principal cities of the world.
Manufacturing in the United States, United Kingdom,
Canada, Netherlands, Germany, France, Japan.

In Industrial and Commercial Installations...

WAGNER®
SUBURBAN
PAD MOUNTED TRANSFORMERS

conserve space and eliminate costly, ugly enclosures

When you plan a new distribution substation, or rework or modernize an existing system, write Wagner® Sub-Urban pad mounted transformers into your standards. They are contained in compact, tamper-proof housings that make costly, ugly, fenced enclosures unnecessary. Save space, too. They're so well ventilated they can be installed up close to the building and still be loaded to capacity. Some low shrubbery will hide them neatly . . . the good looks of your buildings and landscaping are retained. People who use the buildings served by pad mounted transformers are protected from exposed hot-lines, and your crews are protected by a door over the primary compartment which lets them work on the secondary without danger from high voltage. Enclosures lock tightly to protect the equipment itself.

Wagner Sub-Urban pad mounted transformers are available in single-phase, 25-167 kva; three-phase, 75-750 kva. They require only routine maintenance, and when load growth makes it necessary, larger transformers can be quickly and easily installed to replace original units.

Check with your Wagner Sales Engineer. He's got complete data on Sub-Urban pad mounted transformers.. all the facts and figures that prove how easy it is to plan less costly, space-saving transformer installations.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

Wagner Electric Corporation

6413 PLYMOUTH AVENUE, ST. LOUIS 33, MISSOURI

This Wagner Sub-Urban transformer is installed at the Park Ridge, Illinois, executive offices of the Square D Company. It is a 500 kva, three-phase delta-connected, 4160 volt primary transformer.

These transformers serve the Dorcherster Club in Dolton, Illinois. The larger transformer supplies power to refrigerate an indoor skating rink. The smaller unit powers the club's general services and all-electric kitchen.

WT61-3

Portable Dip Tank Rack For Coil Impregnation

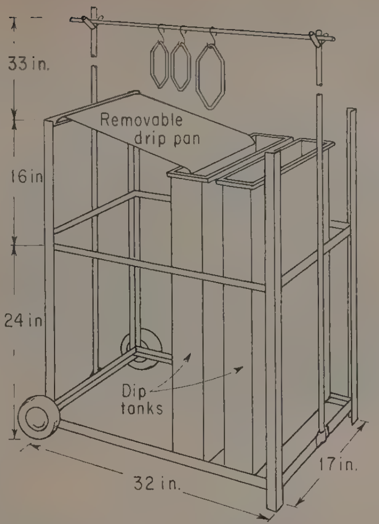
When more than one type of insulating varnish or impregnating compound is used in a motor repair shop to impregnate coils for different service conditions, dipping facilities present a problem. Separate dip tanks are needed for each type of compound and these take space generally at or near the bake oven. More often than not, such space is extremely hard to find in a busy shop.

One solution to the problem is evident at Leverance Electric Motor Service, Wausau, Wis. Walter Leverance designed and built his own slender rectangular tanks, placed them in a mobile rack equipped with coil suspension poles and drip pans. One of the tanks contains silicone rubber compound; the other, standard insulating varnish. There is space for additional tanks. Although the rack can be moved anywhere in the shop, it is usually located in the coil department near the coil spreading unit.

Less than 4 sq ft of floor space is required by the rack assembly. The unit has a rectangular base of 1½ in. angle-iron about 32-in. long and 17-in. wide. Four angle-iron (1½ in.) corner uprights, some 40 in. in height, have end cross-pieces to support inclined, removable drain pans which return varnish residue to the tanks. At 24-in. height, a perimeter rail of 1-in. flat-iron connects the four corner posts; provides a box-like frame in which the removable dip tanks are placed. Two 73-in. high metal uprights, centered and fastened to the ends of the tank rack, support cross-poles from which impregnated coils are suspended after dipping. Rack mobility is provided by two 6-in. wheels at one end of the base frame. Two stationary feet at the other end assures rigidity when the rack is in use.

The comparatively narrow dip tanks are of metal construction; are 5¼ in. by 16 in. by 34 in. high and each has a drain valve near the base. Removal from or replacement in the rack is a relatively simple chore.

Normal procedure is to hand-dip the newly formed coils in the selected insulating compound. After a sufficient interval to assure proper impregnation, the coils are lifted out and suspended from the cross-poles above the tanks. Excess varnish drains off the coils, is caught by the drip pans and returned to the tank. This saves varnish and helps keep the floor under the rack clean. Groups of impregnated coils can then be baked and put through additional insulation processing if necessary.



MOBILE RACK holds a number of deep, slender dip-tanks for coil impregnation. Each tank contains a different type of compound for insulating coils to meet specific operating condition.

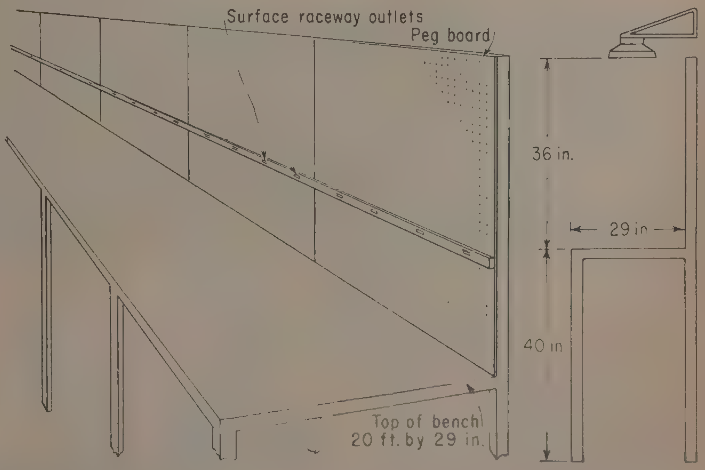
Peg-Board Workbench Ups Shop Efficiency

Adequate work space, good housekeeping, modern equipment and technical know-how are prime ingredients of an efficient motor repair shop operation. The first two sometimes are hard to come by, particularly where shop space is at a premium. Latest trend among some of the smaller shops is to use long, continuous workbenches along one wall and keep the floor area free for heavier equipment on dollies and rolling work tables.

One shop following this trend is Oskosh Electric Co., Oskosh, Wis. But management, in the persons of W. Mengert and R. O. Mueller, goes a step further. These shop operators believe that each important tool item should be in its place, always visible and within easy reach of the mechanic. So they have added a peg-board back to their long wall bench. No longer must men backtrack for tools, or dig in crammed drawers for a specific item. In fact, the workbench has no drawers. Tools are mounted on the peg-board with a variety of hooks and brackets. Now, a mechanic quickly spots the tool he needs, takes it, uses it, and returns it when he is finished. A wall telephone on the backboard, centered on the long bench, saves time and trouble in answering calls.

The wall bench in the Oskosh shop is 20-ft long, 29-in. wide and 40-in. high. The peg-board back is 3-ft high and extends full length. Mounted to the backboard, 16 in. above bench level, is a continuous run of multi-outlet surface raceway. This provides 25 receptacles spaced on 6-in. and 12-in. centers along the bench.

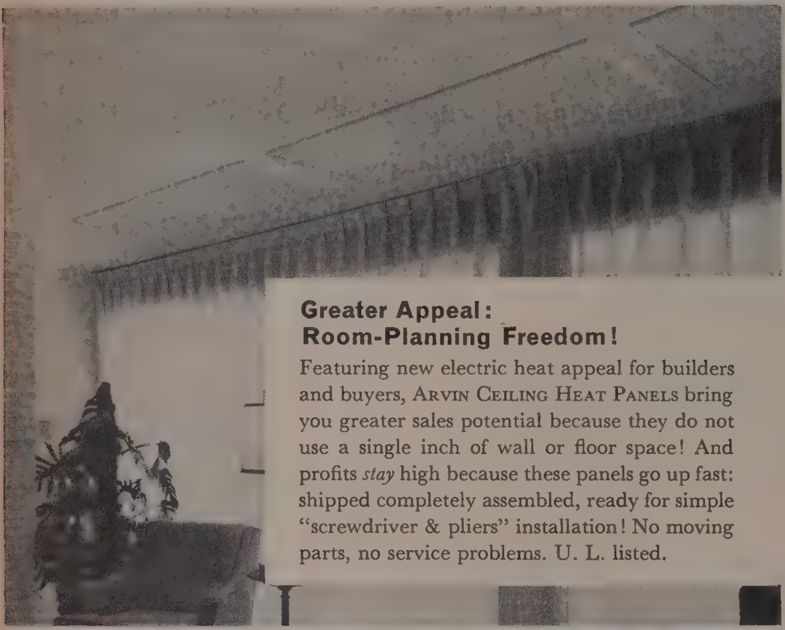
Good lighting also contributes to mechanic efficiency. Sturdy angle-



PEG-BOARD BACK on long wall bench provides adequate space for keeping tools in sight and within arm's reach. Note surface outlets and bench lighting.

Arvin Electric Invisa-Panels solve your space problems . . . and they're more profitable, too!

(Shown as Featured Recently in a Better Homes & Gardens Idea Home)

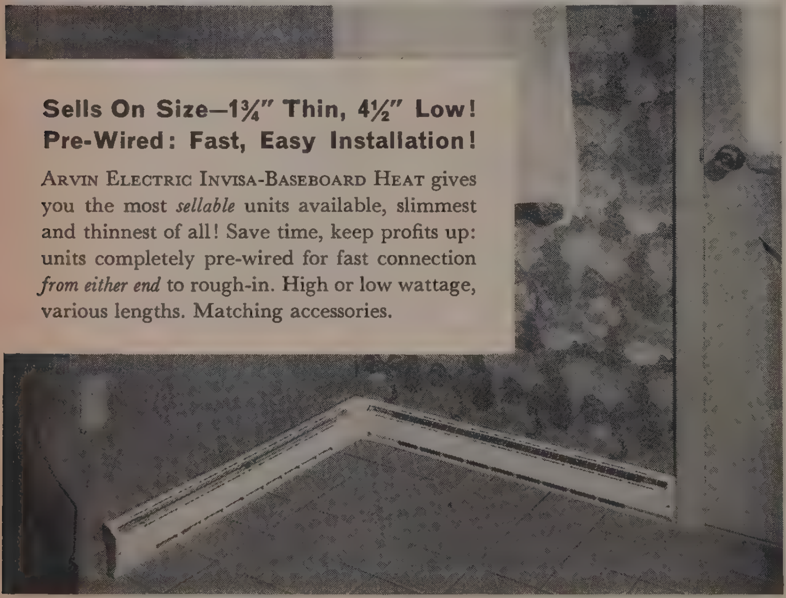


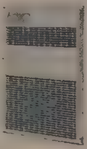
Greater Appeal: Room-Planning Freedom!

Featuring new electric heat appeal for builders and buyers, ARVIN CEILING HEAT PANELS bring you greater sales potential because they do not use a single inch of wall or floor space! And profits *stay* high because these panels go up fast: shipped completely assembled, ready for simple "screwdriver & pliers" installation! No moving parts, no service problems. U. L. listed.

Sells On Size—1¾" Thin, 4½" Low! Pre-Wired: Fast, Easy Installation!

ARVIN ELECTRIC INVISA-BASEBOARD HEAT gives you the most *sellable* units available, slimmest and thinnest of all! Save time, keep profits up: units completely pre-wired for fast connection *from either end* to rough-in. High or low wattage, various lengths. Matching accessories.





ARVIN BUILT-IN WALL HEATERS

A complete line—seven fan-forced radiant models, from 3413 to 13,652 BTU capacities. Instant-heating elements. Each model features new-design rough-in box, quick-fastening clamps for new or old construction.

See Arvin Electric Heat at These Shows:

Int'l H&AC: Booths N230 & N232—Chicago Amphitheater

Write or call Arvin for facts and folders. No obligation.

Arvin®
Electric Heat Division
ARVIN INDUSTRIES, INC. · COLUMBUS, INDIANA

A LEADING NAME IN ELECTRIC HEAT PRODUCTS FOR 28 YEARS

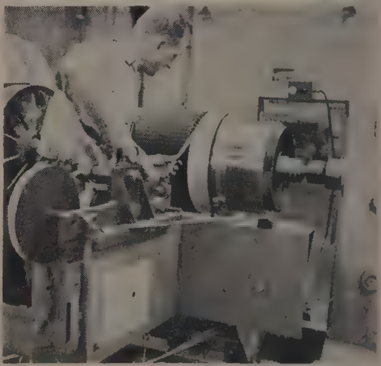
iron wall brackets suspend a continuous row of five 4-ft fluorescent industrial type fixtures 36 in. above bench top. Each fixture has two 40-watt fluorescent lamps.

Normally, small motors and equipment are tested and repaired at the long wall bench. Larger and heavier units are placed on dollies and rolling work tables which can be moved to any place in the shop, including work stations along the bench.

Banding Armatures With Glass Tape

High tensile strength, non-woven glass tape is replacing steel wire as banding material on armatures. Users report safer installation (no hazard from breaking and backlashing as with stressed steel wire), material savings, and considerable reduction in banding time. And it is being used on large as well as small armatures. One reported application was on a 100-ton, 14-ft diameter, double-armature motor for a large rolling mill.

The tape is made of high-tensile glass yarns laid parallel in prescribed widths (standard ⅜ in., ½ in., ¾ in. and 1 in.) and bonded with thermosetting resins. It is supplied in a semi-cured, soft, well-balanced, flat "ribbon" form rolled, spooled or reeled in varying lengths. Since the yarns are not woven, the tape utilizes the full tensile strength of the glass and produces a high-tensile, high-modulus, low-elongation, high-impact-strength band. Its high arc resistance does much to eliminate flashover failures in arma-



ARMATURE BANDING with high-tensile, non-woven glass tape. Tape (Res-i-glas in this shop) passes through roller-type tension device before being wound on armature rotating in banding lathe. Banding takes from 15 to 60 minutes depending on armature size. Glass tape is "cured" by baking; forms solid, firm, high-tensile-strength band.

LUKENS STEEL COMPANY'S NEW ELECTRICAL FURNACE draws power from the new Brandywine main substation by 15kv, single conductor, 600 MCM Okolite-insulated cable in underground ducts. New furnace is part of Lukens' plant expansion program, designed and constructed by United Engineers and Constructors Inc. of Philadelphia.

How Okonite Cable'bility* protects plant profits at Lukens Steel

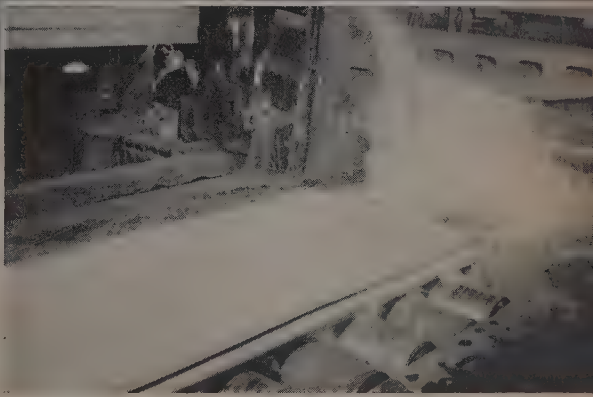
ukens Steel Company, like hundreds of leading corporations throughout ie world, makes extensive use of Okonite cable for its crucial electrical ircuits. They have found that long-lived, dependable Okonite cables are idispensable on important applications to maintain profitable production -an assurance based on the excellent service records of Okonite cables in ieir own and other plants. There are four basic reasons for these service ecords:

1. **Engineering experience,** derived from developing long-lived cables for every type of industrial application.
2. **Manufacturing skill,** achieved by more than 80 years' work with all known insulating methods.
3. **Quality control,** assured by the strictest, most thorough testing methods in the industry.
4. **Quality materials,** maintained without compromise for every component and through every stage of manufacture.

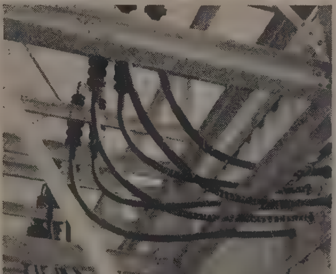
hese four basics mean that Okonite cables will be able to meet your most iallenging specifications with long-lasting protection, maintenance-free ervice. This is typified by the proved service record of Okolite insulation -used by Lukens Steel for its critical high voltage feeders. This insulation as a 30-year record in all types of installations demanding resistance to zone, moisture and heat, as well as high dielectric strength.

nd for more information about Okonite insulated cables and its appli- itions. Also available from Okonite: Bulletin 1098 "Power and Control ables for Steel Mills."

KONITE Cable'bility...cable craftsmanship since 1878



ONE OF THE NATION'S LARGEST ROLLING MILLS—Lukens' 206-inch mill is a good example of essential mass production equipment whose continuous operation is assured by the use of Okonite cables in crucial power circuits.

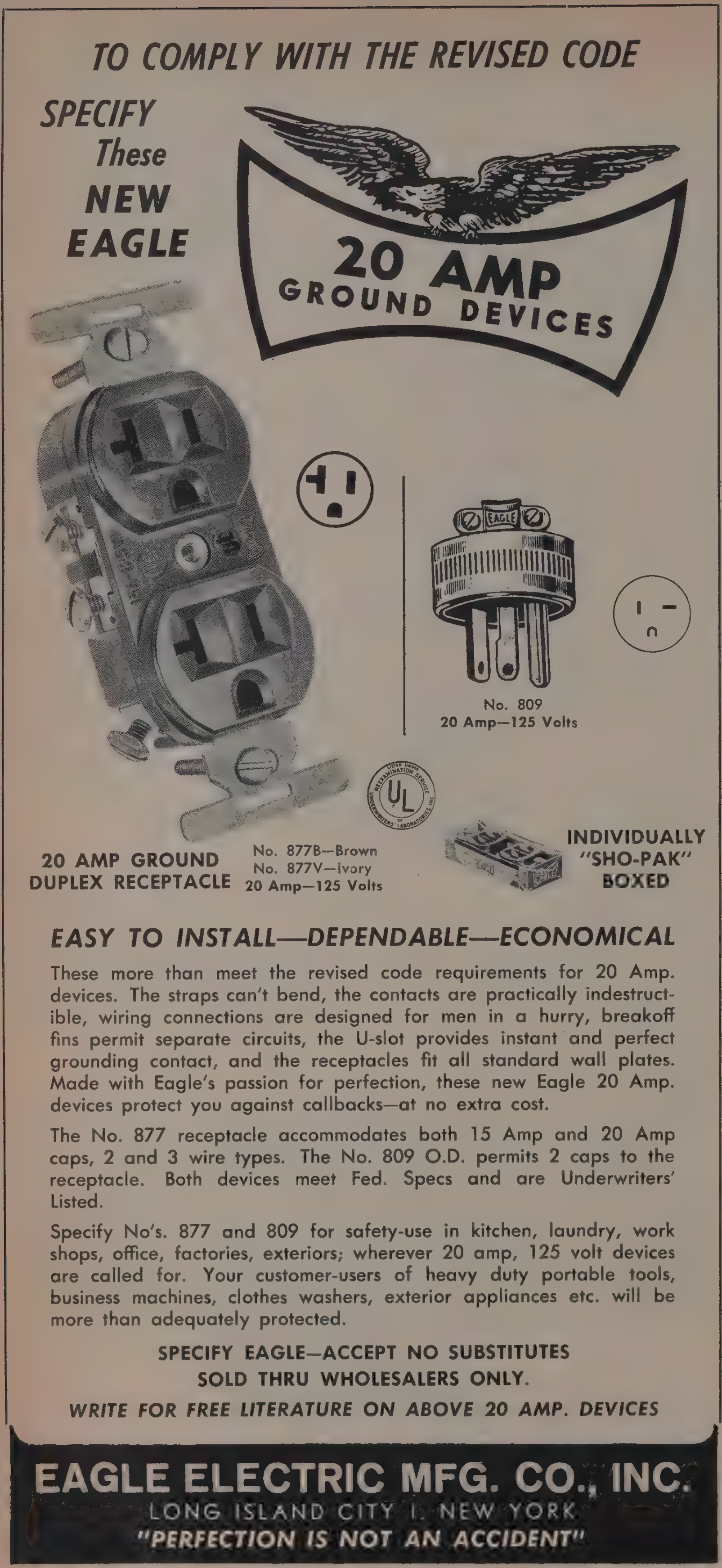


LUKENS' BRANDYWINE SUBSTATION steps down power for the existing Lukens plant and proposed expansion. From this key substation the main feeder for the expansion is Okolite-insulated cable for 23kv ungrounded service—a tribute to Lukens' past experience with Okonite cables.

THE OKONITE COMPANY
Subsidiary of Kennecott Copper Corporation
Passaic, New Jersey

where there's electrical power . . . there's **OKONITE CABLE**

6545-REV.



TO COMPLY WITH THE REVISED CODE

SPECIFY These NEW EAGLE

20 AMP GROUND DEVICES

No. 809
20 Amp—125 Volts

20 AMP GROUND DUPLEX RECEPTACLE

No. 877B—Brown
No. 877V—Ivory
20 Amp—125 Volts

INDIVIDUALLY "SHO-PAK" BOXED

EASY TO INSTALL—DEPENDABLE—ECONOMICAL

These more than meet the revised code requirements for 20 Amp. devices. The straps can't bend, the contacts are practically indestructible, wiring connections are designed for men in a hurry, breakoff fins permit separate circuits, the U-slot provides instant and perfect grounding contact, and the receptacles fit all standard wall plates. Made with Eagle's passion for perfection, these new Eagle 20 Amp. devices protect you against callbacks—at no extra cost.

The No. 877 receptacle accommodates both 15 Amp and 20 Amp caps, 2 and 3 wire types. The No. 809 O.D. permits 2 caps to the receptacle. Both devices meet Fed. Specs and are Underwriters' Listed.

Specify No's. 877 and 809 for safety-use in kitchen, laundry, work shops, office, factories, exteriors; wherever 20 amp, 125 volt devices are called for. Your customer-users of heavy duty portable tools, business machines, clothes washers, exterior appliances etc. will be more than adequately protected.

SPECIFY EAGLE—ACCEPT NO SUBSTITUTES
SOLD THRU WHOLESALERS ONLY.

WRITE FOR FREE LITERATURE ON ABOVE 20 AMP. DEVICES

EAGLE ELECTRIC MFG. CO., INC.
LONG ISLAND CITY 1, NEW YORK
"PERFECTION IS NOT AN ACCIDENT"

tures. Because the tape is itself an insulation, no insulating pad is required between the tape and coils. And creepage problems, sometimes experienced with steel wire bands, are eliminated.

Banding with glass tape is a relatively simple operation. On its way from reel to armature, the tape passes through a roller-type tensioning device; is applied in rows and layers to obtain the required banding strength. Throughout the banding operation, tape manufacturers' recommendations should be followed with respect to proper banding tension and tape overlap. Some manufacturers recommend butt-lapping; others permit overlap. One manufacturer recommends application tension of 550 lbs per inch width for highly stressed, heavy-duty armatures with proportionately less tension on lighter and more fragile coils.

With steel wire, total band strength is a product of the tensile strength of the wire (ultimate limit) and the number of turns applied. The same is true of glass banding tape. Here the manufacturers' "cured" tensile strength of the selected width of glass band is used. Strength calculations for transition from wire banding to glass tape banding are quite simple. If the size, number of turns, and tensile strength of the wire band are known, the total band strength can be determined. Dividing this total by the "cured" tensile strength of the selected glass tape width (manufacturers' table) gives the number of turns of glass tape needed to match the original band strength.

Glass banding requires curing after application. This usually means three to four hours of baking at 325° F. During early stages of curing, the glass tape resins "flow" and fill all voids and air spaces in the band. This action welds the tape laminate into a homogeneous mass that clings cohesively to destruction. In effect, this resin flow tends to anchor the coil against side movement and molds the glass band to coil configuration for added stability under operating conditions. The cured band is firm, solid and springy.

Field reports indicate a 75% or more saving in banding time when using glass banding tape. Depending on armature size, glass tape banding can be applied in from 15 to 60 minutes. One shop reported armatures that used to require three to four hours can now be banded in 30 minutes or less.

Strong Reasons

for specifying rigid conduit in STEEL

Proved Strength

Recent comparison tests indicate that Rigid Steel Conduit is up to ten times stronger than rigid conduit made from aluminum. Steel conduit provides these strength advantages:

—300 to 1000 pct *greater resistance to impact*, depending on the magnitude of the impact and the conduit size.

—100 to 250 pct *greater beam strength* at either the full section or the threaded joint, depending on the load and the conduit size.

—150 pct *greater resistance to flattening* from static loads.

Proved Dependability

For over 50 years Rigid Steel Conduit has provided electrical circuit wiring with the most thorough mechanical protection available. *And it still does.* Inexpensive to buy, easy to install, simple to rewire, steel conduit is highly compatible with every construction material in major use.

Get the strongest protection—be sure to specify rigid conduit in steel for your next electrical job. Ask your electrical distributor for full details.

Steel

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA. *Export Sales: Bethlehem Steel Export Corporation*

for strength
. . . economy
. . . versatility

BETHLEHEM STEEL

BETHLEHEM STEEL

The learned buyer of motor control centers

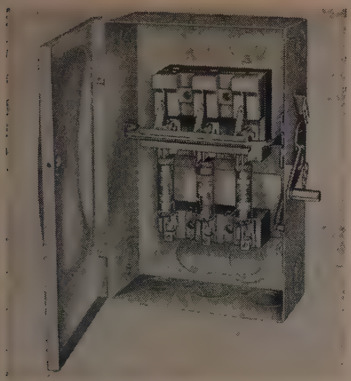
The circuit breakers hardly show on a modern motor control center. But they do the work. Get good circuit breakers and you get good protection . . . extra insurance of continuous electric power . . . lowest net cost. Get poor breakers and you invite trouble. What make can you buy most confidently? Motor control center builders prefer I-T-E over all other makes. Better value. Yet costs no more.

Write for the new bulletin on I-T-E molded case circuit breakers. I-T-E Circuit Breaker Company, Dept. SA, 1900 Hamilton Street, Philadelphia 30, Pa.

I-T-E

I-T-E CIRCUIT BREAKER COMPANY

Product News



Safety Switch (1)

A new 100-amp heavy-duty safety switch for commercial and industrial installations. Interlocking indicating cover can be opened only when switch is in the "off" position, and switch cannot be operated when cover is open. Features are knife-blade contacts and all current-carrying parts silver-plated; visible blade to show at a glance that switch is in "off" or open position; and compact design providing maximum wiring space in gutters. The switch, fusible or non-fusible, is supplied with NEMA 1 enclosure. Available with two, three or four poles, it has voltage ratings of 240, 480 and 600 volts ac, and 250 volts dc.

Arrow-Hart & Hegeman Co., Hartford, Conn.

Low Voltage Switchgear (2)

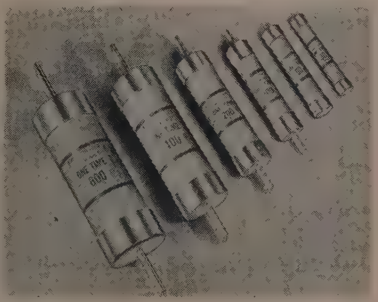
New design in low voltage draw-out switchgear incorporates complete compartmentation of breakers, bus and cable termination. As part of a load center substation, switchgear is for use in industrial and commercial applications using 600 volts ac and below. Compartmentation isolates switch from bus assembly and bus from line connections. Bus construction combines welded aluminum conductors with silver-plated copper terminations eliminating need for periodic tightening of bus bolts. All control devices and instruments, including fuses, are readily accessible from front of equipment. Current transformers are mounted around breaker studs in breaker compartment. Breakers can be racked to "connected," "tests" or "disconnect" position with the door closed.

General Electric Co., Low Voltage Switchgear Dept., Philadelphia, Pa.

Humidity Control (3)

A new sensitive humidity control, designated Type HC-842, is designed to control humidity in conjunction with Chromalox electric comfort heating equipment. Control may be used to operate an exhaust fan which discharges moist air and draws in outside air to replace it. This operation balances the humidity to pre-set level of unit. It has a range of 10% to 100% with a 4% differential. It is rated 125 va for 115/230 volt ac and 45 va for 115-volt dc.

Edwin L. Wiegand Company, 7500 *Thomas Blvd., Pittsburgh* 8, *Pa.*



Fuse (4)

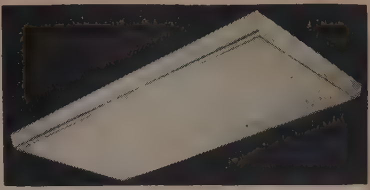
A new One-Time fuse with silver-plated contacts, has long time delay, low watt loss and gives predictable performance. It carries UL seal of listing. It is specifically designed to meet the safety requirements of modern ac-dc circuits.

Chase-Shawmut Company, 374 *Merrimac St., Newburyport, Mass.*

Ballast (5)

A new "A" quiet-rated fluorescent lamp ballast for operation of two 40-watt rapid-start fluorescent lamps has been developed. Ballast absorbs the magnetic vibration of the core and coil before it becomes sound, a new concept that is achieved with a thermo-liable compound. Catalog No. RQM-2S40, incorporates the "Kool-Koil" principle. They are applicable in lighting installations in schools, hospitals, libraries and other critical areas where absence of noise is primary consideration.

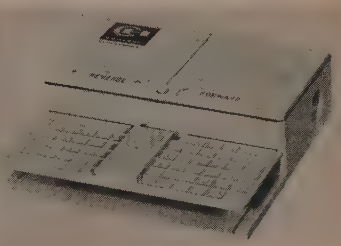
Advance Transformer Co., 2950 *N. Western Ave., Chicago* 18, *Ill.*



Fluorescent Fixture (6)

Slenderline, a new, shallow-contour, surface-mounted line of fluorescent lighting fixtures has been announced. They are 3¼ in. deep overall and made in two models—1 ft wide by 4 ft long for two rapid start fluorescent lamps; and 2 ft wide by 4 ft long for four or six rapid-start lamps. Available diffusers include plastic louver, lens, and drop acrylic. Other features include: slide-mounted ballasts; hinged, envelope type, metal diffuser frame which may be opened from either side, or removed and replaced without tools; and indirectly lighted metal sides which blend the fixtures into the ceiling when the luminaires are mounted in continuous rows. Luminaires are finished in baked-on white enamel.

Solar Light Manufacturing Co., 400 *North Ashland Ave., Chicago* 22, *Ill.*



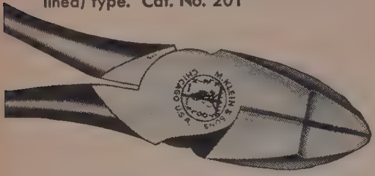
Foot Switches (7)

Two new treadle-operated foot switches available in designer-styled enclosures. Both Type A standard duty and Type C heavy duty foot switches are designed for ac and dc pilot circuit control. Standard duty switch is 2-position, spring return and front treadle operated. Pressure on treadle closes NO contacts and release of pressure returns switch to NC contacts. Heavy-duty foot switch contains two contact blocks and is side treadle operated, which can be adjusted in the field from 3-position spring return to 2- or 3-position maintained contacts.

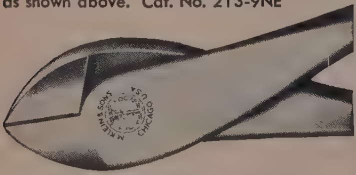
Cutler-Hammer, Inc., 228 *N.* 12*th St., Milwaukee, Wis.*

KLEINS
for LINEMEN
and ELECTRICIANS

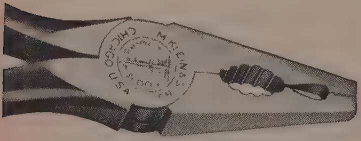
The Original Klein Side Cutting Plier—Also available in NE (Streamlined) type. Cat. No. 201



High Leverage Plier—Extra high leverage permits cutting extremely tough wire. Also available in the standard type as shown above. Cat. No. 213-9NE



High Leverage Oblique Cutting Plier—A recently introduced plier designed to cut toughest wire. Cat. No. 228-8



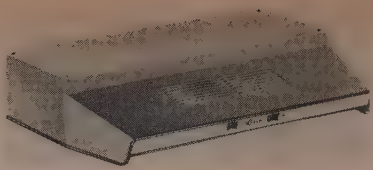
Electrician Conduit Plier—Reams inside and outside of conduit, tightens lock nuts in outlet boxes. Cat. No. 333-8

"Since 1857" the name Klein has stood for the finest in tools and equipment for linemen and electricians. It is the uncompromising high quality back of the name Klein that has won Klein Pliers their place in the hands of men who know good tools. Klein Pliers are now available in a wider variety of styles and sizes than ever before. Be sure the pliers you need carry the Klein trade-mark.

Klein Catalog Free—This new Klein catalog giving complete information on Klein tools and equipment for linemen and electricians will be sent on request. Write for your copy.

Ask Your Supplier—Foreign Distributor: International Standard Electric Corp., N.Y.

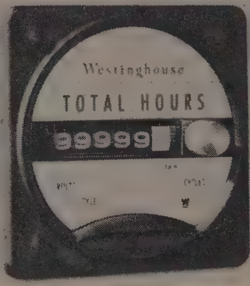
Mathias KLEIN & Sons
Established 1857 Chicago, Ill., U.S.A.
7200 McCormick Road • Chicago 45, Illinois



Range Hood (8)

A new Series 62 Electro-Filter range hood is a self-contained air filtering unit. It is easily installed under existing cabinets and requires simple wiring into a 120-volt circuit. Aluminum grease filter and electronic plates are removable and can be cleaned in warm water and detergent. Two 75-watt light bulbs in hood provide cooking-surface illumination. Hood is available with copper or stainless steel finish, in 24-, 30-, 36- and 42-in. lengths.

Fasco Industries Inc., Davis & Toppin Sts., Rochester 2, N. Y.



Time Meter (9)

A new elapsed time meter, Type BH-351, with or without reset knob and mounted from either the front or back of panel, is available. Since meter indicates total time that a particular circuit is energized, it is suited for such applications as tube replacement programs and maintenance scheduling of electrical equipment, including diesel generators, motors, welders, and radio and television transmitters. Six register wheels are provided.

Westinghouse Electric Corp., P. O. Box 2099, Pittsburgh 30, Pa.

Receptacles (10)

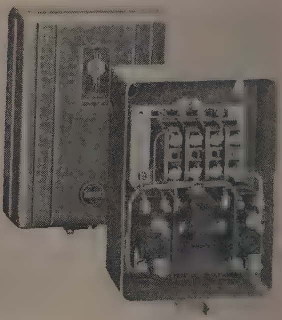
In addition to meeting new requirements in the 1959 NEC, new 20-amp receptacles may be used for either 20 or 15 amps, 125 volts, ac; available in both single and duplex outlet types. Because of its slot design, they will accept both the new NEMA 20-amp grounding cap and standard 15-amp parallel blade cap. Both single and duplex types are available in Sierra with conventional styling, and Sierraplex with rectangular design. Listed by UL. Bulletin is available.

Sierra Electric Corp., 15100 South Figueroa St., Box 85, Gardena, Calif.

Circuit Breaker (11)

A new Type QO tandem circuit breaker has been introduced. Combining two full-size breakers in a single space-saving unit, the QO tandem features ambient-temperature compensation, trip indication and full-size handles. Qwik-open thermal-magnetic construction gives full "flash protection." Magnetic element opens on first flash, and thermal element holds on overloads. To double the number of two poles, adjacent breaker handles can be tied together by a QO handle tie. Available in ratings of 15 and 20 amps, QO tandem circuit breakers can be used in all standard Type QO load centers. Bulletin QO is available.

Square D Company, Mercer Road, Lexington, Ky.



Starters and Contactors (12)

Bulletin 6013 Type CY Size 00 starter and Bulletin 7707 Type CY Size 00 contactor are designed for non-reversing, full-voltage starting of $\frac{1}{8}$- to 2-hp squirrel-cage motors. The same unit can be used on either single-phase or 3-phase motors operating on 110- to 600-volt power, and 25- to 60-cycle frequencies. Starters are equipped with melting-alloy, thermal-overload relays. On single phase, only one overload is required. Available as open type or in NEMA Type 1, general purpose enclosures in three forms: Form MA for separate pushbutton operation; Form MB with "Hand-Off-Automatic" selector switch; and Form MC with "Start-Stop" pushbutton.

Clark Controller Co., 1146 East 152d St., Cleveland 10, Ohio

FREE

New Wire-Pulling Compound

INTRODUCTORY OFFER

ONE "piggy-back" QUART (90¢ value)

SLIKON

FREE with every gallon

Men who pull wire like the slick pull they get with SLIKON.

Yes, Sir . . . the treat's on Burndy! You get a FREE "piggy-back" quart of SLIKON with every gallon you buy at the regular $2.88 price.

Try the quart . . . if you're not satisfied, return the gallon to your local Burndy distributor and get your money back. Offer good for a limited time only.

COMPARE THESE FEATURES

SLIKON never hardens . . . never settles . . . never evaporates in the can . . . It's an engineered lubricant . . . there are 9 full pounds in every gallon. U/L approved for steel, aluminum and other recommended conduit. Safe for rubber, most plastics, and lead coatings.

BURNDY

61-3

NORWALK, CONNECT. BICC—BURNDY Ltd. Prescot, Lancs., England In Continental Europe: Antwerp, Belgium TORONTO, CANADA

NEW BULLETIN FREE . . . Gives weights, sizes and performance features of Standard's dry type line.

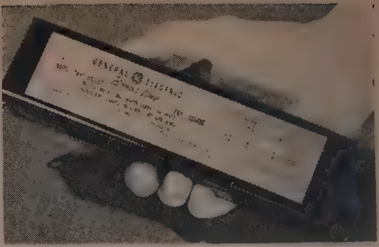
Standard Transformer co.
DRY TYPE TRANSFORMERS
FOR LIGHT, POWER AND CONTROL
THE STANDARD TRANSFORMER CO.

Standard dry type transformers for light, power and control are designed for service wherever equipment is required in hazardous areas. Most major oil companies use them. Standard's compound fills the entire case, hardens and seals out lint, dust and dirt. They cut noise levels, improve regulation, reduce temperature rise and are lighter in weight and smaller in size.

Get the facts today from your nearby Standard representative or write directly to us.

Standard Transformer co.

EXPRESS 2-1563 • WARREN, OHIO
"WHEREVER THERE IS POWER"



Protected Ballast (13)

A new line of fluorescent lamp ballasts for indoor commercial and industrial applications features full protection against such hazards of end-of-life failure as smoking, burning, rupture, or compound leakage. Designated as the Bonus Line, ballasts have non-resetting thermal protectors that take the units permanently off the line when abnormal point-of-failure temperatures are reached. One protector at coil assembly operates at temperature at which compound softens to point of leaking. Another thermal link in the capacitor de-energizes the capacitor before internal temperatures reach a destructive level. Ballasts are dimensionally, thermally and electrically interchangeable with standard ballasts of same ratings; available in all popular ratings for indoor commercial and industrial lighting.

General Electric Company, Schenectady 5, N. Y.

Diffuser (14)

A new 2- by 4-ft Gratelite louver diffuser includes the ⅜-in. open plastic cubicles, with optimum 45° by 45° shielding. They offer flexibility and ease of installation with Guth Una-Tee suspension systems—each Gratelite panel is supported on all four sides for positive alignment. Brochure is available.

Edwin F. Guth Company, P. O. Box 7079, St. Louis 77, Mo.

Hanger (15)

A new hanger for banks of electrical conduit and pipe features one-piece clamps, automatic alignment, interchangeability of pipes within the bank and a wide variety of clamp sizes. Same clamp fits both iron and other pipes. Conduit or pipe is held against a channel iron by spring alloy aluminum clamps which merely slide over pipe and are held by slots in channel. A cam on clamp holds it in place. Literature is available.

Stamperhanger Company, 1634 Telegraph Ave., Oakland 12, Calif.

nstalling
Electric Heat?

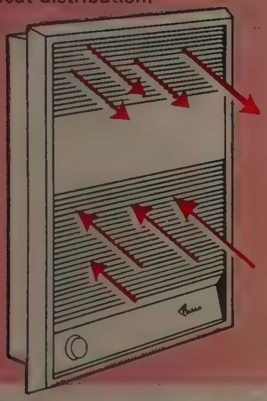
CHECK

hese built-in values first!

FASCO
FORCED AIR HEATERS

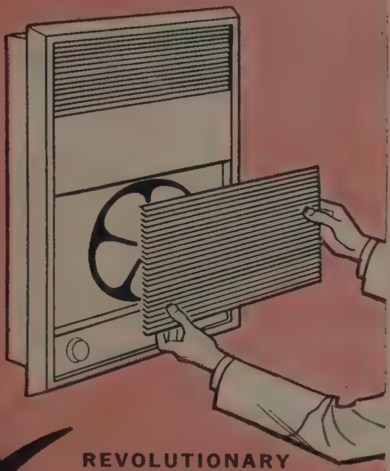
UNIQUE EFFICIENT AIR-FLOW PATTERN

werful, quiet fan draws air in ough bottom louvers, forces it up er heating elements, then out ough top louvers which directs the downward providing uniform om-heat distribution.



REMOVABLE GRILLES

Both top and bottom grilles snap easily in and out for quick access to operating areas. Enables unit to be installed simply and cleaned periodically.



REVOLUTIONARY HELICAL FINS

The helical fin tubular heating element assures maximum heating efficiency. This type of element is especially designed for long life and trouble-free operation.

Fasco forced air heaters are styled to please and designed to perform longer and better . . . just the right space-saving units to provide heat wherever it's needed—recreation room, hall, living room, garage, or anywhere in the house. Built for the comfort of modern living, these thermostatically-controlled heaters are designed around true heating efficiency, giving a flow of even heat.

These rugged, well-built heaters add to a room's appearance, give years of trouble-free customer satisfaction . . . eliminating costly call-backs for service or adjustment. They are compact, simple to wire-in, and fit between standard-spaced studs. Four convenient sizes to match room requirements . . . 1500, 2000, 3000 and 4000 watts (all 240 volts).

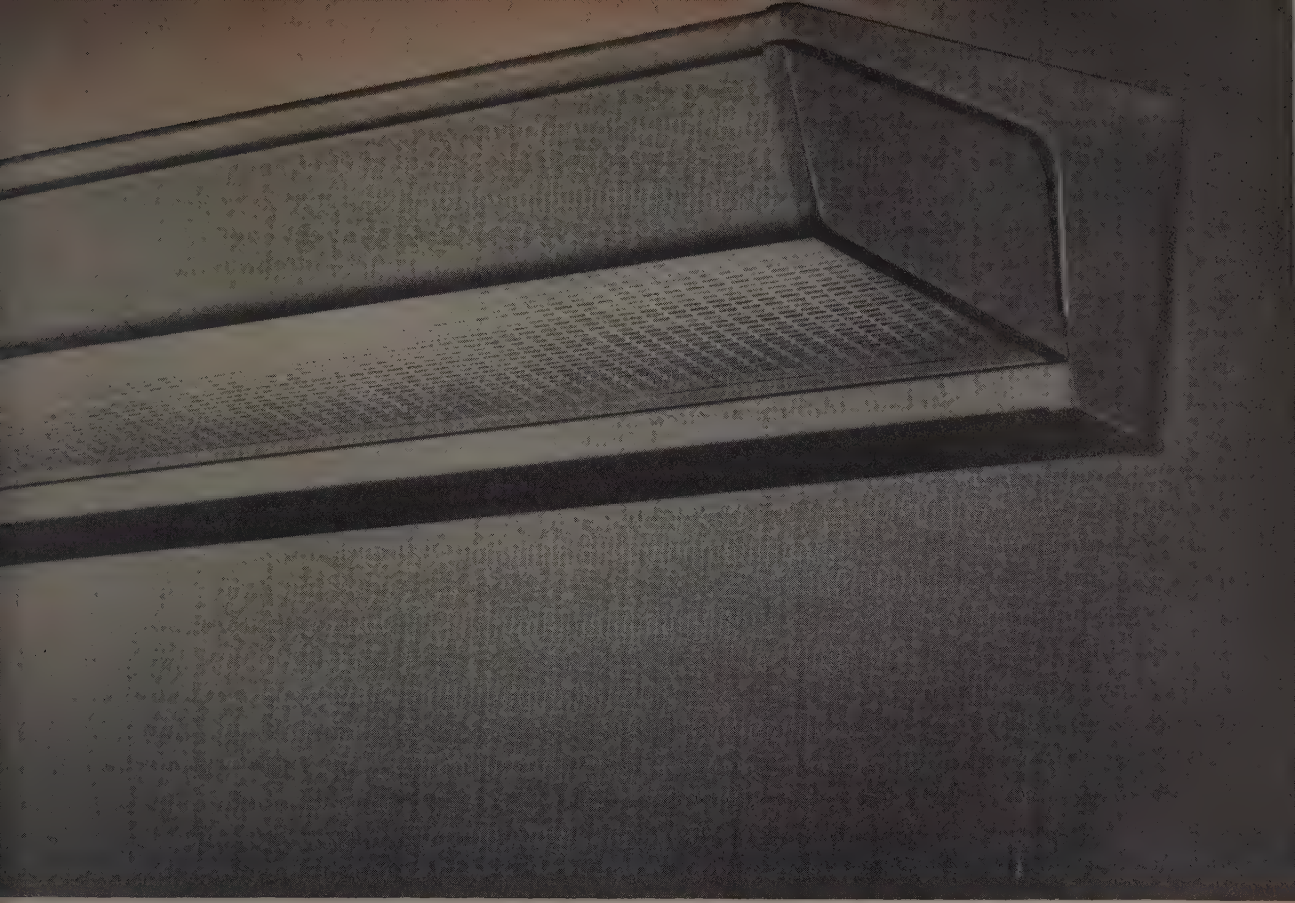
FASCO INDUSTRIES, INC.
Rochester 2, N. Y.

FASCO

"Setting the Pace in Electric Heat"

See the difference TRANQUILITE makes in transforming a cold, harshly-lighted hospital room into an attractive, modern settin

Patients look better, see better . . . even feel better!



TRANQUILITE ...a "Decidedly Better" Hospital Bed Light by DAY-BRITE

- Switching provides reading light, night light and general illumination
- Convenient electric outlet for examining light, electric razor or radio
- No annoying glare . . . ideal for multiple-patient rooms and wards
- Available in 2 or 4-foot lengths, stainless steel or baked white enamel finish

First time you see it you'll know that here's a behind-the-bed fluorescent hospital fixture worthy of the Day-Brite name—with the clean lines and quality look you expect from America's first name in lighting equipment.

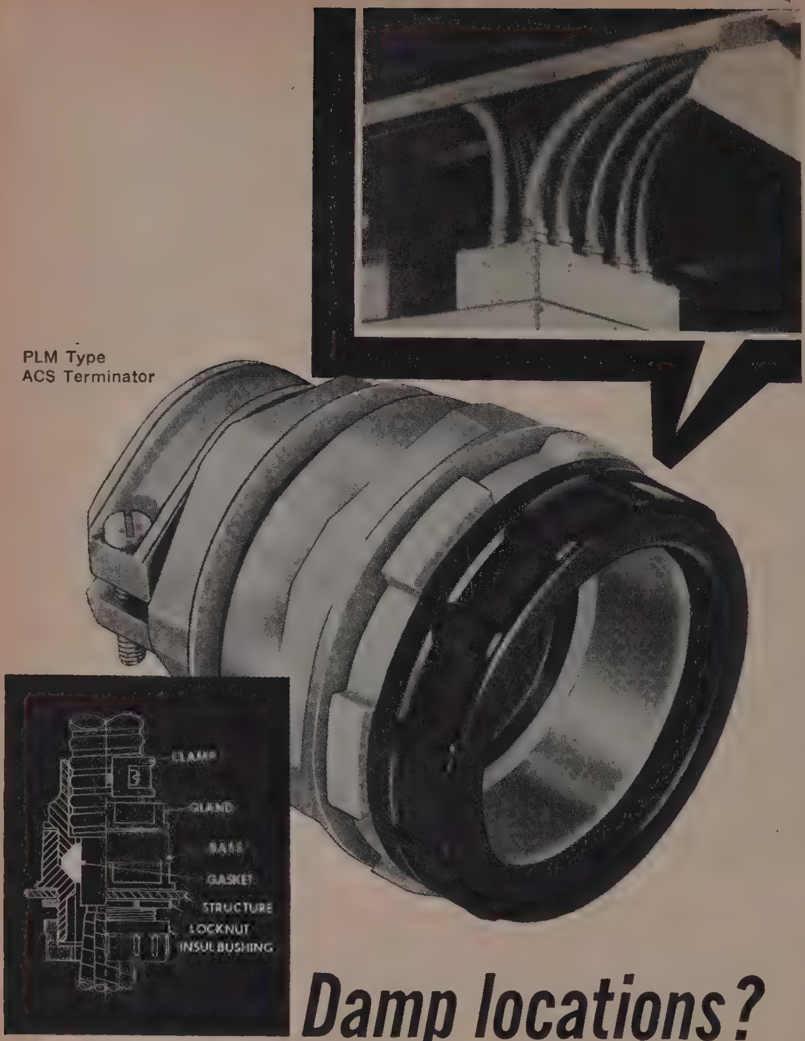
But only when you have seen it in action can you fully appreciate what an amazing difference TRANQUILITE makes. Cold, clinical-looking hospital rooms take on new warmth . . . become more inviting. In older rooms, TRANQUILITE's soft illumination hides defects . . . adds a modern touch.

TRANQUILITE is just one of a complete line of "Decidedly Better" Day-Brite fixtures for every hospital need. All are/easy to install/easy to clean/easy to maintain. Get the full story from your Day-Brite representative, or write: **Day-Brite Lighting, Inc., 6260 N. Broadway, St. Louis 15, Mo., and Santa Clara, Calif. In Canada: Amalgamated Electric Corp., Ltd., Toronto 6, Ont.**

DAY-BRITE®

NATION'S LARGEST MANUFACTURER OF COMMERCIAL AND INDUSTRIAL LIGHTING EQUIPMENT

PLM Type
ACS Terminator



Damp locations?

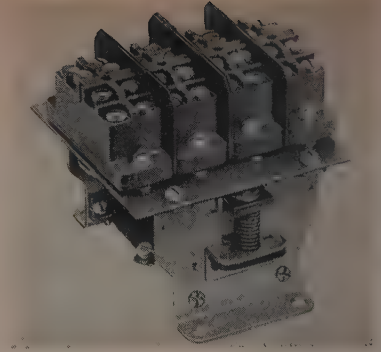
There's a PLM fitting to fit the job!

Installing armored cable where conditions call for moisture-tight terminators? There's a PLM fitting to fit the job—as well as others to fit almost any other type of indoor or outdoor mounting requirement!

PLM terminators for armored cable, and PLM terminating and splicing kits for armored, non-metallic jacketed and lead-covered cable through 23 kv. can simplify and speed up any cable installation and repair. Get full information on these time and money saving PLM products. They are fully described in PLM 52-page catalog 301. Write for copy on your letterhead.

PLM Products, Inc
TERMINATING AND
SPLICING ACCESSORIES

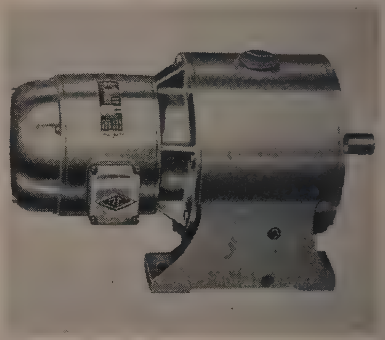
3875 WEST 150th STREET • CLEVELAND 11, OHIO



Relays **(16)**

The use of a new 2-pole snap switch has extended the number of poles available on Class 8501 Type P relays. A total of eight normally open and eight normally closed contacts can now be obtained in less than 14 in. of panel area. Each pole of Type P relays consist of a precision snap switch with double-break, double-throw contacts. Single-pole snap switches are used in 1-, 2-, 3- and 4-pole devices, and the new 2-pole snap switch in the 6- and 8-pole models. Contact mechanism on Type P relays is totally enclosed. Non-inductive rating is 10 amps.

Square D Company, 4041 *North Richards St., Milwaukee* 12, *Wis.*



Speed Reducers **(17)**

Helical Motoreducers are now available as an integral motor and gear reducer package in all ratings from ½ hp through 50 hp. In addition to the wide horsepower range, each unit is also available as standard with an unusual selection of drive motors. Typical of the drive motors are Fluid-Shaft, wound rotor slip-ring, squirrel-cage, crane-hoist and torque; drip-proof or totally enclosed. Applications for these Motoreducer packages are found wherever machinery requires a low-speed, high torque output.

Reuland Electric Co., Alhambra, Calif.

Expert Commendation...On Two Outstanding HOLOPHANE PRISMALUME® Installations...

HOLOFLUX® NO. 6434
in Offices of La Salle Casualty Co.

"...high level illumination without the usual painful glare"

Statement from Mr. Irving M. Addis, Architect, reporting on the illumination of new offices for La Salle Casualty Co., Chicago, Illinois.

"The lighting throughout the entire area is Holophane #6434 set into a flush mounted acoustical grid ceiling. The illumination level of 130 foot-candles was met without difficulty...The installation has proved to be extremely satisfactory from the decorative as well as illumination standpoint....Office personnel and management like the high level of illumination without the usual painful glare...Holophane is to be congratulated on the efficiency of the fixtures and the complete co-operation of its staff.

Irving M. Addis

Irving M. Addis, Architect

It is always gratifying to receive favorable notice of products or services...The compliments take on special significance when they come from knowledgeable sources....Added incentives to spur Holophane engineers toward new and higher areas of lighting achievement.

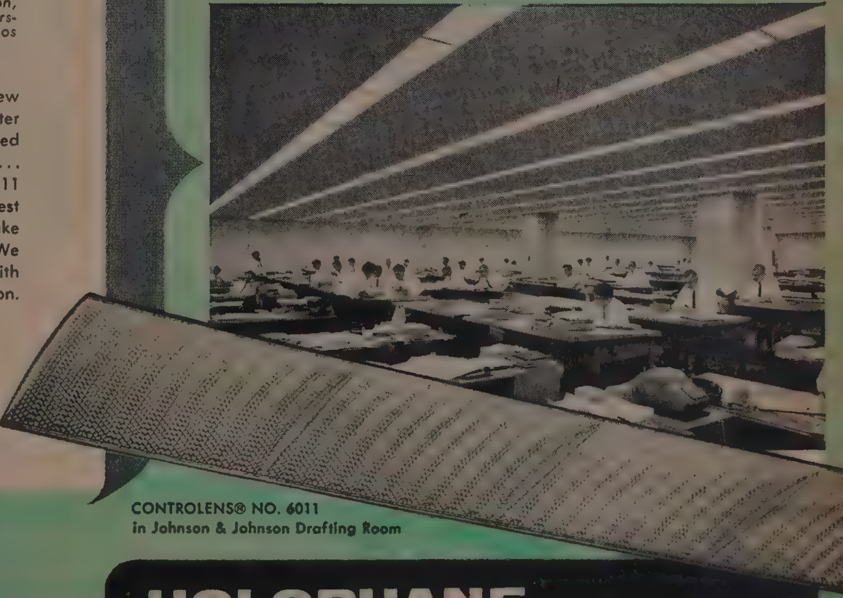
"We take pride in showing our clients our new offices"...

Excerpt from a letter by Mr. J. H. Johnson, President of Johnson & Johnson, Engineers-Architects, Inc., Chicago, Illinois and Los Angeles, California

We selected Holophane lenses for lighting our new offices and 9000 sq. ft. drafting room...After comparing several types of lighting we decided that a lens enclosed unit would be required...Further study proved that Holophane #6011 acrylic plastic Controlens provides the highest efficiency with precise control of glare...We take pride in showing our clients our new offices. We are particularly proud of our drafting room with 160 footcandles of uniform, glare-free illumination.

J. H. Johnson

J. H. Johnson, President



CONTROLENS® NO. 6011
in Johnson & Johnson Drafting Room

Holophane
Trade Mark

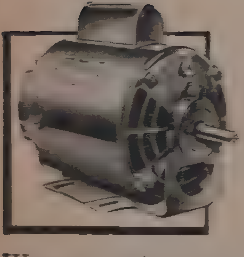
[illegible]

HOLOPHANE COMPANY, INC.
342 Madison Ave., New York 17, N. Y.
THE HOLOPHANE CO., LTD., 418 KIPLING AVE. SO., TORONTO 18, ONT.

MAKE IT YOUR PROFITABLE BUSINESS TO USE GENUINE WAGNER® MOTOR PARTS

KEEP YOUR WAGNER MOTORS ALL WAGNER

It's good business to use genuine Wagner® Motor Parts on every Wagner motor you repair or rebuild. That's because they *are* genuine . . . exactly like the parts they replace. Top quality, they fit right . . . work right always. You make repairs faster and more profitably . . . get results that build customer confidence and repeat business. So keep the Wagner motors you repair *all* Wagner, and profit.



IF THE MOTOR ISN'T WORTH REPAIRING, SELL A NEW WAGNER® MOTOR

Today, more than ever, there are times when it just doesn't pay to repair an old motor . . . times when both you and your customers lose unless the motor is replaced.

By replacing worn-out motors with new Wagner motors you remove any doubt about making a profit on repairing a badly worn motor, and save time for other repair work. Best of all, you make profit on every Wagner motor sale, plus giving your customers over-the-counter service. Contact your Wagner distributor now . . . get the motors and point-of-sale merchandising aids that will help you cash in on replacement motor sales.

Wagner Electric Corporation

6413 PLYMOUTH AVENUE, ST. LOUIS 33, MO., U. S. A.

OVER 850 AUTHORIZED SERVICE STATIONS OR PARTS DISTRIBUTORS

MOTORS • BEARINGS • STANDARD ROTORS • BRUSHES • CAPACITORS • COMMUTATORS

Intercom System **(18)**

A new automatic dial telephone business intercom, Fanon 1010, provides the convenience of an automatic dial system with full trunkage, an individual 2-way conversation for every pair of phones in the system. All switching is accomplished by the telephones themselves which permit both "private" talking of up to five separate conversations or a "common talking" conference facility between a number of telephones. Maximum number of dial telephones that can be used in system is eleven. If 6-master dial phones are used, each can have five remote telephones associated with it, or a total of 36 stations in the system. Master dial phones can interconnect each other's remote telephones. System operates on six to nine volts, dc which is supplied by a 110-volt ac power supply.

Fanon Electronic Industries, Inc., 439 *Frelinghuysen Ave., Newark* 12, *N. J.*

Heaters **(19)**

A new line of infrared overhead spot heaters, designated as Cat. No. VOH, features a tubular element constructed of Corning's Vycor silica glass, frosted inside and out. Tube element has high thermal shock characteristics which make it suited for outdoor use and exposure to freezing rain, snow, etc. It is unaffected by acid and alkaline atmospheres and is suitable for use in industrial locations. Heaters are designed so that their infrared emissions are concentrated and directed to a local area. They are available in 1000-, 1500-, 2000-, 2500- and 3000-watt models, 120-, 208-, 240- and 277-volt.

Berko Electric Mfg. Corp., 212-40 *Jamaica Ave., Queens Village, N. Y.*

Only C-L-X®

Continuous Lightweight eXterior

Sealed Cable Systems by Simplex Can do so Many Jobs so Well

Simplex C-L-X is a packaged combination of cable and an extremely pliable, corrugated metal sheath. It requires no separate duct or conduit regardless of environment. It is available with steel sheath and plastic jacketing; and with copper or aluminum sheaths, with or without plastic jacketing.

C-L-X Cuts Installation Costs

By using a single length of 3-conductor 15KV C-L-X for both underground and aerial use, a Southeastern utility company saved more than 20,000 dollars from what it would have cost for a complete underground duct system.

Resists Chemical Attack

Conduit life in this company's calcium chloride reclamation building was only 6 to 9 months. The conduit was replaced with a C-L-X cable system which — after two years of operation, shows no signs of deterioration.

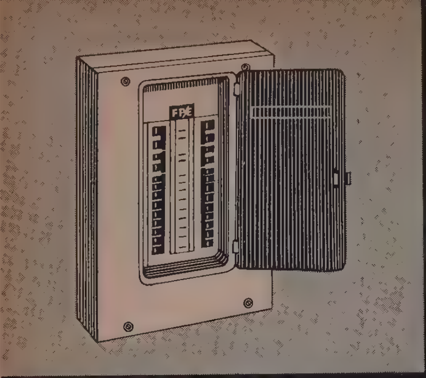
Protects Against Liquids and Gases

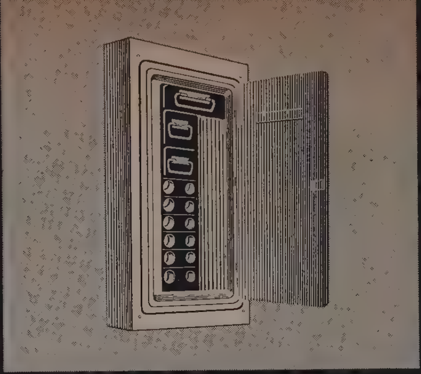
An East Coast petroleum tank farm used a C-L-X 8-conductor cable protected with PVC for direct burial in ground that was saturated with oil, gas and water. Result: Perfect performance at a sizeable savings over conduit systems.

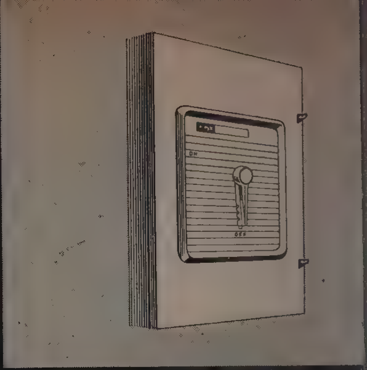
Only Simplex C-L-X offers you: Exceptional Strength . . . Unequalled Pliability . . . Protection from Liquids and Gases . . . Faster Installation and Lower Costs. Send for Illustrated Brochure containing Application and Engineering Data.

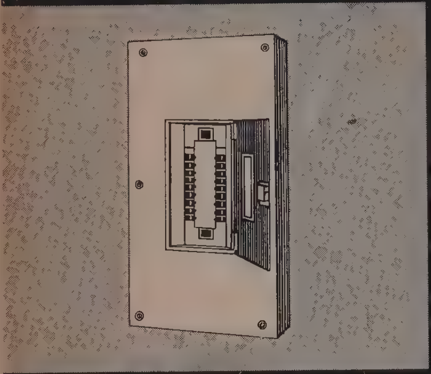
SIMPLEX WIRE & CABLE CO

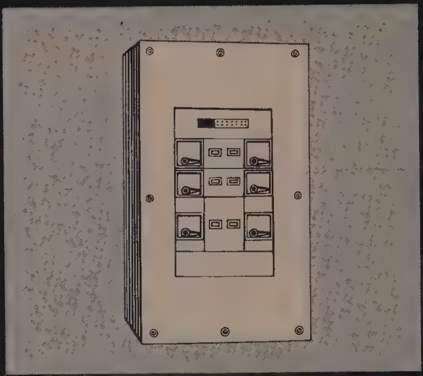
CAMBRIDGE, MASSACHUSETTS

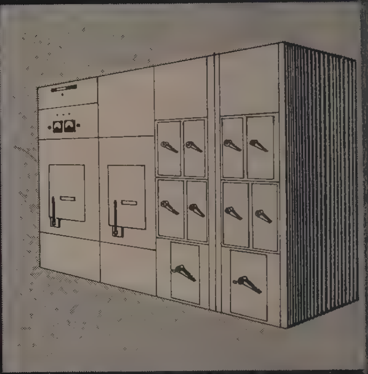

Stab-lok® Load Centers

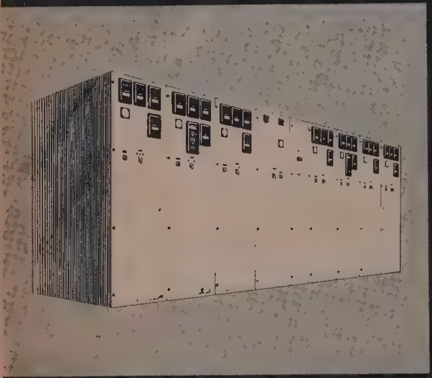

SF Fusible Load Centers

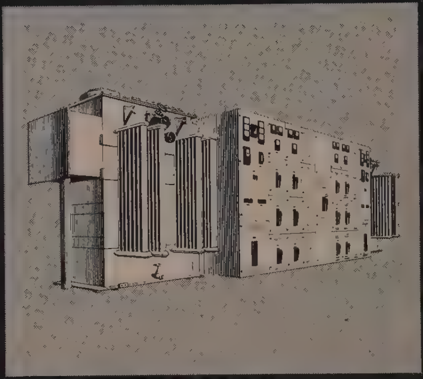

Safety Switches

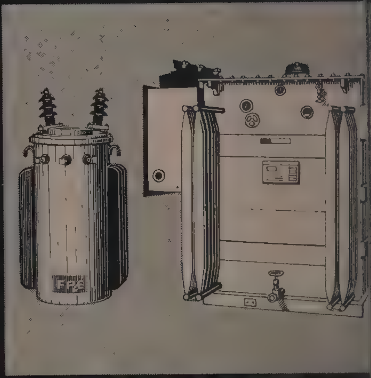

Lighting Panels


Power Panels


Switchboards


Metal-Clad HV Switchgear


Unit Substations


Distribution and Power Transformers

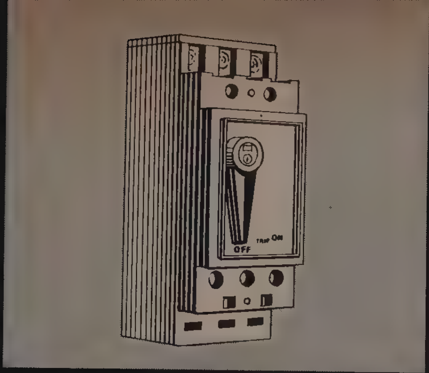
There are 9,987 listed products in

73%

are the industry's most advanced

The new FPE Redi-Reference Catalog belongs on your desk if you are an architect or consulting engineer, designer or builder, contractor, distributor, plant engineer or purchasing agent. Within its pages you will find a complete line of electrical products ranging from the smallest home fuse to the largest power circuit breaker. Outstanding examples: the revolutionary Rotary Handle circuit breakers, setting new standards of safety and convenience; compact and easily-operated "A-Plus" safety switches; Dual Element fuses with 100,000 amperes interrupting capacity; the industry's only

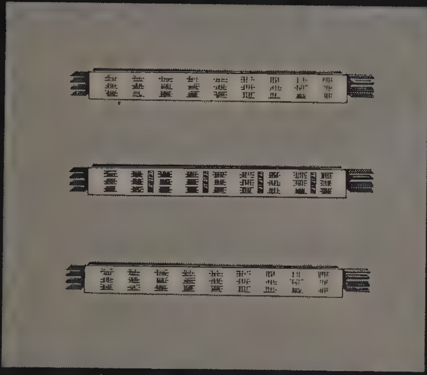
Economy Fuse



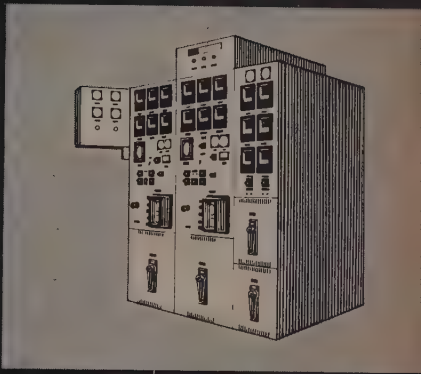
Rotary Handle Breakers

Motor Controls

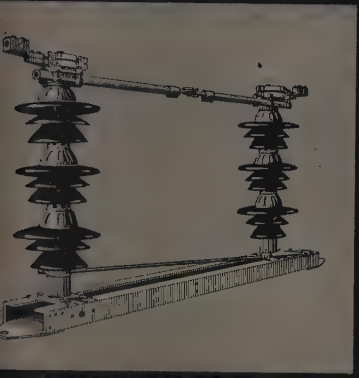
Motor Control Centers



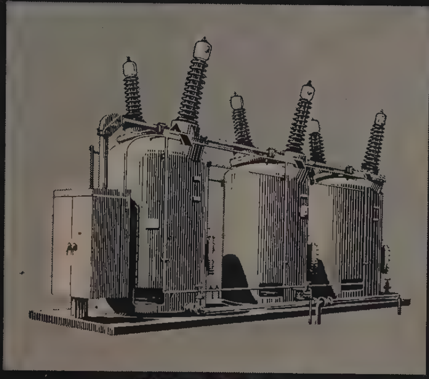
Modular Bus Duct



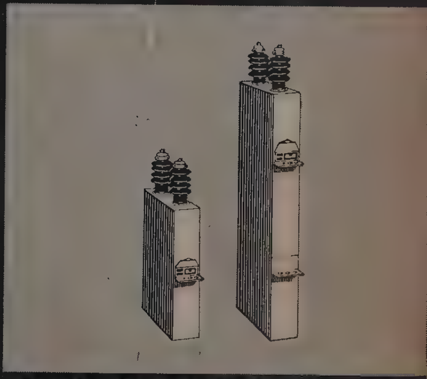
Metal-Enclosed LV Switchgear



Power Disconnect Switches



Oil Circuit Breakers



Power Capacitors, and other electronic components

the new FPE Redi-Reference

27%

are just the industry's finest!

fully-modular plug-in lines for circuit breaker and fusible load centers, with advanced Non-Interchangeability systems. If you have a stake in selecting the best in electrical control, distribution and power equipment for homes, commercial or institutional buildings, for industrial plants or utility systems, you will find the Federal Pacific Redi-Reference invaluable. We welcome your inquiry. Federal Pacific Electric Co., 50 Paris St., Newark 1, N. J.

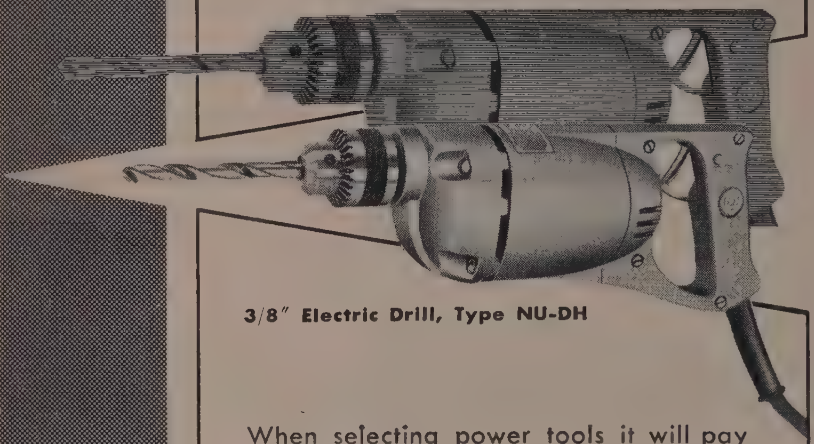
FEDERAL PACIFIC ELECTRIC COMPANY

FPE

growth through creative energy

HITACHI

ELECTRIC
TOOLS



3/8" Electric Drill, Type NU-DH

When selecting power tools it will pay to consider the trouble-free Hitachi line, for they are backed by forty years' experience as well as their famous name. Hitachi produces 75% of Japan's power tools, which are exported to Southeast Asia, South America, and other destinations.

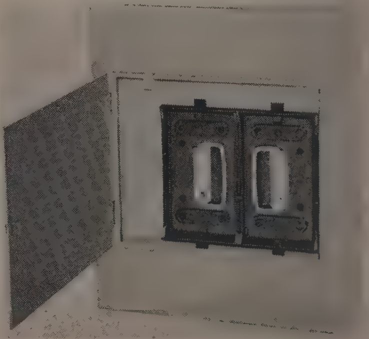
Portable Electric Drills
Electric Bench Drills
Portable Electric Grinders
Electric Bench or Floor Grinders
Toolpost Grinders
Angle Plate Grinders
Hand Grinders
Electric Resinoid Grinders
Electric Sanders
Electric Orbital Sanders
Electric Line Sanders
Portable Electric Polishers
Electric Bench Polishers
Electric Tappers
Electric Screw Drivers
Electric Nut Runners
Electric Nibblers
Electric Hand Shears
Electric Jigsaws
Electric Circular Saws
Portable Electric Planers
Portable Electric Blowers
Electric Drill Kit
Drill Chucks

Hitachi, Ltd.
Tokyo Japan
Cable Address: "HITACHY" TOKYO

Capacitor (20)

A new Cornell-Dubilier 50 kvar power capacitor and 100 kvar "Slim Jim" power capacitor. Rated 2400 volts through 7960 volts, 60 cycle, single phase with single or double bushings, power capacitors are engineered for use in substation stack racks and pole-mounted racks on utility transmission and distribution systems. The 50-kvar capacitor weighs 92 lbs and has a case size of 15½-in. wide, 4½-in. deep and 22½-in. high. The 100-kvar unit weighs 175 lbs and has a case size of 13½-in. wide by 4½-in. deep and 4½-in. high. It meets standard horizontal NEMA mounting dimensions of 15⅝ in. on 7⅛- or 8-in. centers.

Federal Pacific Electric Co., 333 Hamilton Blvd., South Plainfield, N. J.

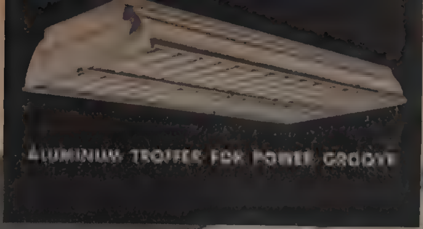


Service Equipment (21)

The new 200-amp split bus was designed for all installations where it is desirable to split the load from 200 amps to two 100 amps. It has two separate 100-amp "Renu-Fuse" units. It is a 3-wire, solid neutral, 120-240 volts, ac switch. The 200-amp line terminals, also the 100-amp load terminals are suitable for aluminum or copper conductors. The door trim and deadfront is the new "Hook-on" type. It is available in both indoor and raintight. It is listed by UL.

Wadsworth Electric Mfg. Co., Inc., Covington, Ky.

Lighting BY miller


ALUMINUM TROFFER FOR POWER GROOVE

General Office Area, Public Service Company of Indiana, Connersville, lighted with Miller Aluminum troffers for Power Groove—125 footcandles maintained. Architect and General Contractor, Huber, Hunt and Nichols, Indianapolis.

LIGHTING BY
miller
SINCE 1844

Miller POWER GROOVE Lighting for Renovation and New Building Projects . . . this office is typical of many where Miller Aluminum troffers teamed with Power Groove Lamps are providing *comfortable*, high footcandle lighting at *lower cost* than ever before possible.

Designed especially for Power Groove, these Aluminum troffers are among a group of important fixtures recently introduced by Miller. Shown below are some other recent additions. For example, the Richmond for Power Groove . . . particularly suitable for lighting stores and public buildings.

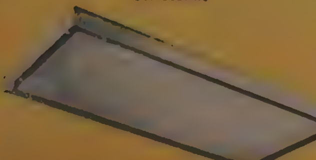
Whatever the interior—Office, Store, School, Factory or Public Building—there's a Miller fixture to meet your needs . . . for use with the fluorescent lamp type of your choice.

For further information on Miller Power Groove Lighting, or help with a specific lighting job or fixture write Dept. 261, or contact your Miller Representative.

THE **miller** COMPANY, MERIDEN, CONN. • UTICA, OHIO

Versatine Troffer

Surfaceline



Richmond for Power Groove

Sabre

INDIVIDUAL PROTECTION STATIONS

SAFELETS

now available with a wide variety of receptacles and circuit breaker ratings

The Heinemann Safelet is a compact unit that neatly combines circuit-breaker safety with plug-in convenience. It has hundreds of applications, can be used for the individual protection of power tools, fractional horsepower motors and almost all general appliances.

Now you can have the Safelet with any of a large number of receptacles, single and duplex, in twist-lock, polarized, "T" slot and other styles.

And now you can have a wide choice of circuit breaker ratings: from 6 to 50 amperes, at the most commonly used a-c and d-c voltages.

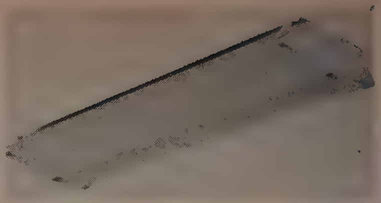
The Safelet enclosure is made of 16-gauge steel with an attractive grey hammertone finish. Units are available for either flush or surface mounting.

Of course, the circuit breakers used are Heinemann breakers . . . long accepted by the electrical industry as the standard of performance.

For full details, send for Bulletin 1000.

HEINEMANN
ELECTRIC COMPANY
132 Plum Street Trenton 2, N. J.

S.A. 1669



Lighting Fixture (22)

Fluorescent surface lighting fixtures that are completely enclosed, designed as Series S16, feature a wrap-around prismatic diffuser extruded from clear polystyrene. Series S16 features end plates of gold anodized aluminum or enameled steel. Two- and 4-light units are available, suitable for individual mounting or in continuous runs. Housings are constructed of cold-rolled steel, die-formed in 4- and 8-ft lengths. Knockouts allow continuous wiring of end-to-end mounted fixtures. Catalog sheet is available.

Litecraft Manufacturing Corp., 100 Dayton Ave., Passaic, N. J.

Control Cable (23)

A new industrial control cable with chemically cross-linked polyethylene insulation. This thermosetting insulation, called Vulkene, combines electrical properties similar to those of polyethylene with thermal properties. Cable has a high overload rating, and is designed for general usage in air, conduit, underground ducts, or for direct burial. Cable can be spliced and terminated in same manner as any other thermosetting type. It is available with a 600-volt or 1000-volt rating in two through 12 conductors, sizes Nos. 14, 12 and 10 AWG with printed conductor identification on the singles.

Wire and Cable Department, General Electric Co., Bridgeport, Conn.

Wire Reel (24)

A new wire reel designed to expedite the job of electrical wiring—domestic, commercial or industrial. Reel will handle single conductor, strand, non-metallic sheathed cable or armored cable. It is equipped with a pivotal guide that enables the wire to be pulled from any direction, and it is also equipped with a guide sleeve that keeps the wire straight and retards back lash.

Browne Electric, Esplanade, Capitola, Calif.

WHEN YOU DESIGN LIGHTING SAVE YOUR CUSTOMERS TROUBLE . . . INCREASE LAMP LIFE . . . KEEP HIGH LIGHTING LEVELS . . . SPECIFY BALLASTS MARKED

CBM CERTIFIED by ETL ®

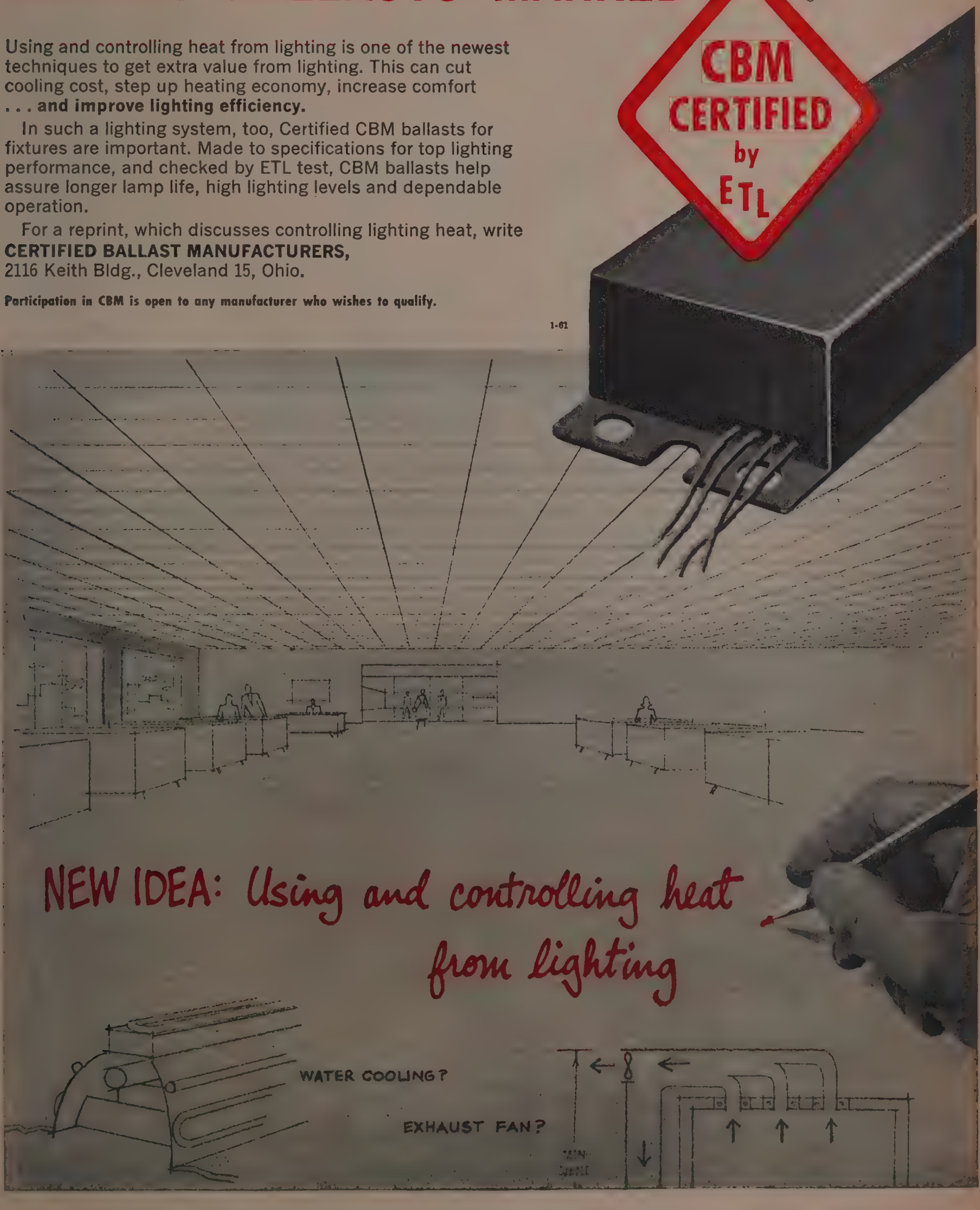
Using and controlling heat from lighting is one of the newest techniques to get extra value from lighting. This can cut cooling cost, step up heating economy, increase comfort . . . **and improve lighting efficiency.**

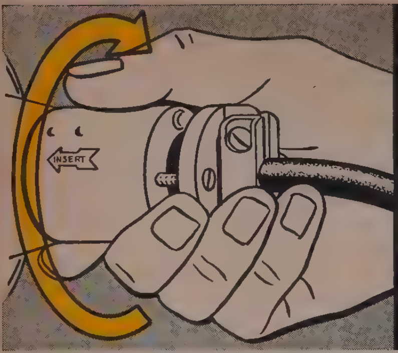
In such a lighting system, too, Certified CBM ballasts for fixtures are important. Made to specifications for top lighting performance, and checked by ETL test, CBM ballasts help assure longer lamp life, high lighting levels and dependable operation.

For a reprint, which discusses controlling lighting heat, write
CERTIFIED BALLAST MANUFACTURERS,
2116 Keith Bldg., Cleveland 15, Ohio.

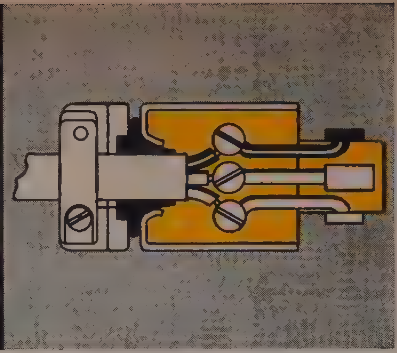
Participation in CBM is open to any manufacturer who wishes to qualify.

1-61

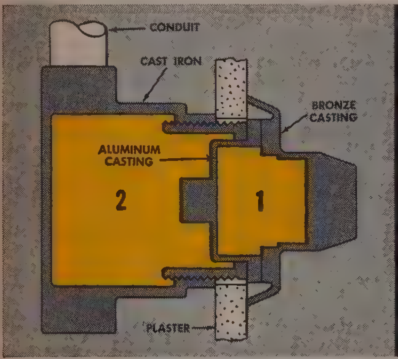

NEW IDEA: Using and controlling heat from lighting
WATER COOLING?
EXHAUST FAN?



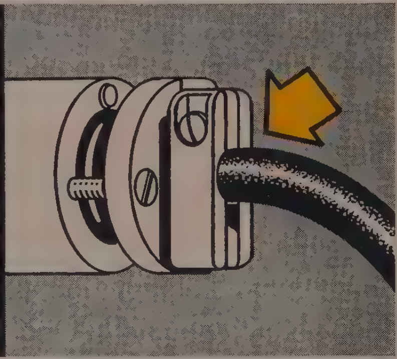
NO ARCING WHEN PLUGGING OR UNPLUGGING. Outlet is electrically "dead" until plug is inserted and rotated 22-25°. Reverse turn disconnects current before plug is removed. Spring pressure and keyed construction prevent accidental disconnection.



NO AIR SPACES INSIDE PLUG TO COLLECT GAS OR MOISTURE. After plug is wired to cord, electrician pours a self-hardening insulating resin into all air spaces. Interior of plug becomes solid, water-tight, vapor-tight mass.



TWO SAFETY CHAMBERS IN WALL OUTLET. Gas-tight chamber No. 1 (bronze and aluminum castings) contains and seals off switching mechanism. Cast iron chamber No. 2 keeps minor internal explosions from spreading to room.



CORD CANNOT PULL OUT OF PLUG. Double-clamping cord-grip relieves strain on plug terminals. And because terminals and wires are completely embedded in insulating resin, connections cannot loosen to cause arcing.

NEW

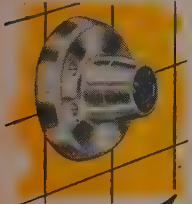
EXPLOSION-PROOF

RECEPTACLE AND PLUG

FOR CLASS I, GROUP C OR D, ATMOSPHERES

The Hubbellock Explosion-Proof Receptacle and Plug prevent arcing when electrical connections are made or broken in explosive atmospheres. No special wiring is required for installation in new or existing structures.

There are no air spaces in the plug where explosive gases can collect. No current can flow to the receptacle contacts while the plug is being inserted or removed. Switching takes place inside a vapor-sealed safety chamber of heavy bronze and aluminum castings.



Any 20-ampere, 125-volt, 60 cycle A.C. appliance may be operated from the receptacle by substituting the Hubbellock Explosion-Proof plug for the present plug. Appliances equipped with the Explosion-Proof plug will also operate in conventional 3-wire Hubbellock receptacles.

Plug and receptacle are listed by Underwriters' Laboratories and are described by the National Fire Protection Association for use in Class I, Group C or D, explosive atmospheres. They are ideal for hazardous industrial areas and for hospital operating and delivery rooms.

Write now for detailed specifications and prices.

"Hubbellock" is a registered trademark of Harvey Hubbell, Inc.

EXPLOSION PROOF Hubbellock® WIRING DEVICES

HARVEY HUBBELL, INCORPORATED • BRIDGEPORT 2, CONNECTICUT In Canada: Scarborough, Ontario

Load Centers **(25)**

Two new "Twin" circuit breaker load centers designed to meet specific service entrance requirements. Cat. No. TRP410, is rated 100 amps and has capacity for up to eight single-pole lighting and appliance circuits when used with G-E "Twin" breakers. Unit meets requirements in those areas with local codes requiring a 100-amp minimum service entrance, but where gas is the primary energy source for major appliances as well as home heating. The second new load center permits use of G-E's new 100-amp Type TQAL plug-in breaker as a main service disconnect and is a functional substitute for G-E's TRM1210 load center which incorporates a main breaker wired in at the factory. It provides up to 20 branch circuits in addition to the 100-amp plug-in main. Rated 125 amps, the new device also can be installed as a main-lugs-only load center with up to eight 2-pole or 20 single-pole circuits. Both units are listed by UL.

General Electric Co., Circuit Protective Devices Dept., Plainville, Conn.

Electric Plant **(26)**

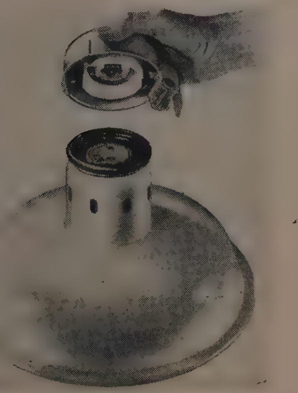
A new heavy-duty electric plant with a dual rating of 85 kw standby and 75 kw continuous duty. It is available in all standard voltages, in models for both gasoline and gas-gasoline operation, in radiator-cooled or city water-cooled models and with either remote or push-button starting. Of 8-cylinder V-type, the engine develops 168 hp at 1800 rpm. Revolving field, 12-lead reconnectible generator has a direct-connected exciter with 24-volt cranking windings. Standard equipment includes automatic voltage regulator, anti-Dieseling device for gasoline models, electric solenoid gas shutoff valve for gas models.

Kohler Co., Kohler, Wis.

Control **(27)**

New photoelectric light controls are light-sensitive switches which automatically turn on outdoor lighting installations such as street lights and service-station lights at predetermined levels of darkness and turn them off when they are no longer needed. Series 4005 is the basic control; 4006 series controls are equipped with an electric timer to preset any desired "off" period and temporarily override the photoelectric cell. Control consists of a cadmium sulphide photoelectric cell with a high dark resistance of plus 5 megohms, which can operate continuously carrying 500 milliwatts of power. It also features a hermetically sealed tungsten-mercury solenoid type switch with a load capacity of 20 to 30 amps at 120 volts or 240 volts ac and an inrush current capacity of 130 amps. Light level setting is adjustable from ½ to 4 footcandles. It is available with a standard 3-prong locking type plug which meets EEI-NEMA specifications.

Revere Electric Mfg. Co., 7420 Lehigh Ave., Chicago 48, Ill.



Reflectors **(28)**

New electrical disconnect reflector, called Lectri-Lok reflector fixture, consists of two separable elements—a die cast aluminum hood and a reflector-socket assembly. The latter is removable as a single unit for cleaning and lamp changing at floor level. The two-piece disconnect socket is shock absorbing and self-centering. Live contacts are protected by barriers that prevent accidental short circuiting when attaching reflector unit. Shallow dome and "RLM" standard dome reflectors are available in 12 to 20 in. diameters. Listed by UL.

Steber Division, The Pyle-National Company, 1334 N. Kostner Ave., Chicago 51, Ill.

For a BIG GRIP on tough jobs in hard-to-reach spots

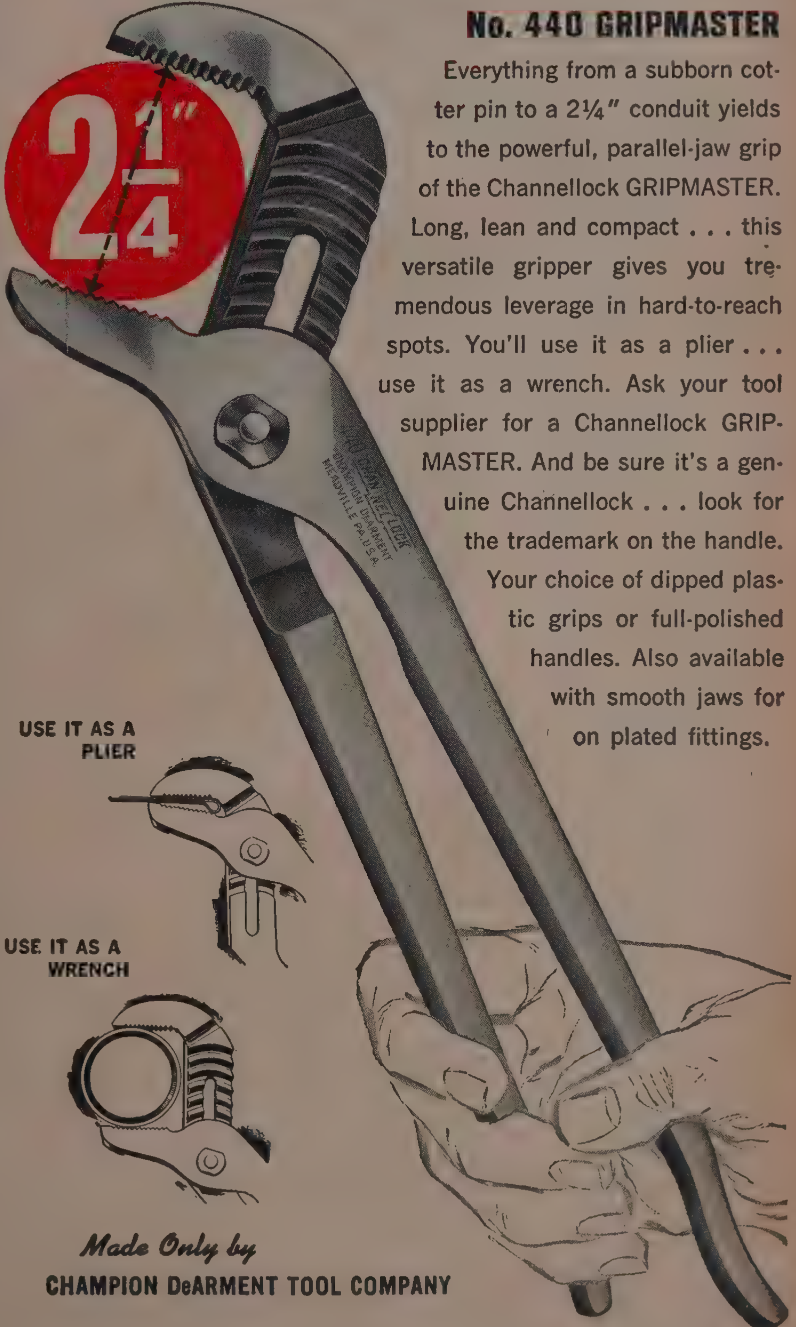
CHAN NEL LOCK®

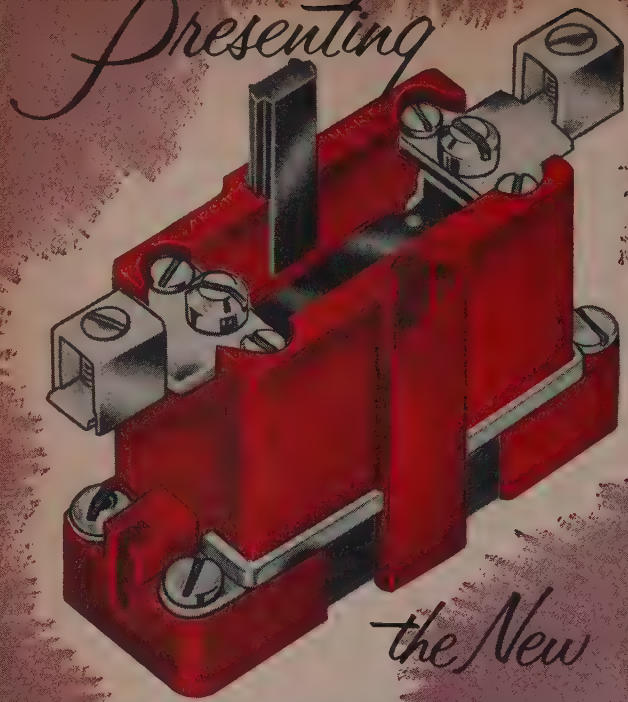
No. 440 GRIPMASTER

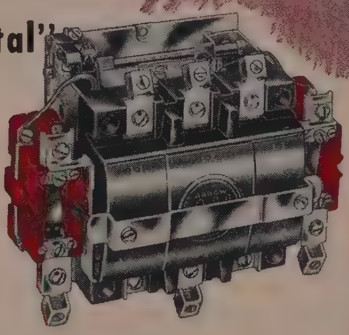
Everything from a subborn cotter pin to a 2¼" conduit yields to the powerful, parallel-jaw grip of the Channellock GRIPMASTER. Long, lean and compact . . . this versatile gripper gives you tremendous leverage in hard-to-reach spots. You'll use it as a plier . . . use it as a wrench. Ask your tool supplier for a Channellock GRIPMASTER. And be sure it's a genuine Channellock . . . look for the trademark on the handle. Your choice of dipped plastic grips or full-polished handles. Also available with smooth jaws for on plated fittings.

Made Only by

CHAMPION DeARMENT TOOL COMPANY







Presenting

the New

AMBIENT COMPENSATED OVERLOAD RELAY with "Balancing Bi-Metal" Exclusive with ARROW-HART

RELIABLE OVERLOAD PROTECTION FROM −20°F TO +165°F!

FOR ALL ARROW-HART "RA" MAGNETIC STARTERS, NEMA SIZES 0 THROUGH 5!

Now, for the first time, you can give your customers reliable overload protection regardless of heat or cold . . . because this compact new A-H Overload Relay operates on the same time curve at all temperatures from −20°F to +165°F. Simple, rugged, dependable mechanism features the exclusive A-H "Balancing Bi-Metal." Much smaller than any other comparable units, these relays have the same base size as standard A-H Overload Relays, use the same regular or quick-trip heaters, and can be used on any A-H Type "RA" Magnetic Starters. Compensation is completely automatic . . . no field adjustment is needed. Available with ratings from 25 to 300 amperes, continuous current. Ideal for use outdoors, in installations subject to wide seasonal changes in ambient temperature . . . or indoors, in installations subject to wide daily changes!

Write today for complete information. The Arrow-Hart & Hegeman Electric Co., Dept ECM 103 Hawthorn St., Hartford 6, Conn.

ARROW AH HART

Quality since 1890

MOTOR CONTROLS · ENCLOSED SWITCHES
APPLIANCE SWITCHES · WIRING DEVICES

ARROW AH HART

Service Equipment (29)

New multi-metering devices, called E-Z Stack, since basic meter-breaker devices can be easily stacked one on top of the other. All devices are bracket suspended and designed for integration into whatever combination is required to custom-fit the available wall space and configuration. Wall brackets support each unit, in its proper place, while permanently securing and inter-connecting the entire installation. Bulletin SL-27 is available.

Square D Company, 1601 *Mercer Road, Lexington, Ky.*

Battery Charger (30)

An all new silicon controlled (SCR) "Full Float" automatic battery charger line for stationary type batteries used by utilities and industrial plants. Current limiting is provided in both the "Float" and "Equalize" positions for overload protection to charger and battery. Units are available from 24-120 volts dc in capacities from 1-125 amps. Silicon power rectifiers and the SCR are hermetically sealed. Bulletin SCR-B5 is available.

Hughes Electronics Company, 5343 *Crenshaw Blvd., Los Angeles* 43, *Calif.*

Cable Reel Dolly (31)

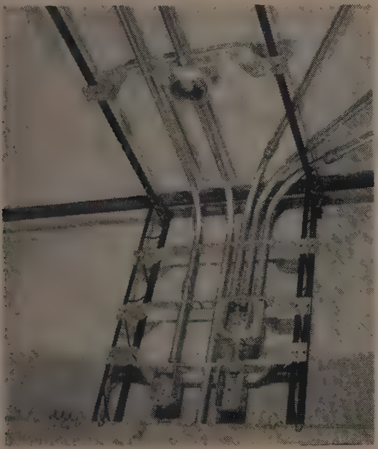
The Magcoa cable-reel dolly is for the handling of large reels of wire or cable and has a loading capacity of 2,000 lbs. It can be used either inside buildings or on open ground. The ratchet settings permit adjustment of rollers for all size reels. Footlock is designed for positive control. The rollers, with heavy-duty bearings, allow up to 30 in. of usable width.

Magnesium Company of America, 155 *S. E.* 10*th Ave., Hialeah, Fla.*

Lighting Units (32)

A new series of acoustical tile trim rounds has been introduced. Each of the trim rounds has a 13-in. sq frame which overlaps onto adjacent tiles. Styles in the H4100 series, all with unwired housings, include: baffle downlight designed for a 150-watt lamp, PAR 38 or R40; open adjustable has a 42° vertical adjustment and 358° rotation. It takes a 150-watt R40 lamp; parallel louvred adjustable permits high-level spotlighting, open ellipsoidal downlight has an ellipsoidal alzac reflector which produces a controlled wide-angle beam using a general service lamp; and louvred eyeball is designed for installations requiring peak lighting efficiency with a decorative touch.

Halo Lighting Products, Inc., 4201 W. Grand Ave., Chicago 51, Ill.



Mounting Bracket (33)

A new heavy-gage metal bracket permits mounting of ceiling and wall outlet boxes between studding; can also be used as a conduit rack or support. Embossed for added strength, the plated bracket has openings for conduit or EMT; is designed to bring plaster rings on boxes flush with plaster line. Branch circuit raceway, with locknut or box connector, passes through bracket opening into box knockout. Tightening of connector or brushing secures box to bracket; prevents lateral movement of box. Brackets can be nailed to wood or wired to metal studs; can be used with 4-in. sq boxes, 2-in. sectional boxes or handy boxes; are ideal for school, hospital, commercial construction and thin partitions. Available in two sizes. "A" with ½-in. KOs "B" with ¾-in. KOs.

Robinson Bracket Company, 705 North 79th St., East St. Louis, Ill.

ARROW AH HART

POSITIVE *with* PROTECTION

ARROW-HART GROUNDING Receptacles

with RIVETED Grounding Contacts and Terminals

5725
20 AMP,
125 VOLT
DOUBLE SIDE GRIP
ONE PIECE CONTACTS OF 1/32" THICK BRONZE
CONTACT RIVETED TO BASE PLATE WITH DOUBLE-HEAD BRASS RIVET

Available Only from ARROW-HART

UL

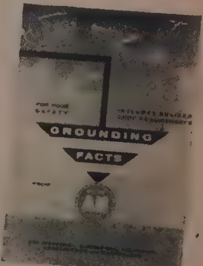
H&H

SPECIFICATION GRADE

Now, positive grounding protection on commercial and industrial installations is assured with Arrow-Hart Grounding Receptacles built with *riveted* grounding contacts and terminals. The U-shaped double grounding contacts and terminals used in Arrow-Hart Specification Grade Grounding Receptacles feature a unique *one-piece construction of heavy 1/32" thick bronze — not brass.* This is mounted on the strap by a brass rivet, headed on both sides. *Exclusive with Arrow-Hart,* this rigid one-piece construction eliminates the possibility of loose joints and of parts turning in the grounding path . . . giving the operator dependable positive protection. Be *safe* — be *sure* — with Arrow-Hart's built-in quality and hidden values!

Complete information on ARROW-HART grounding devices is provided in the new booklet, "Grounding Facts". Write today for your free copy to:

The Arrow-Hart & Hegeman
Electric Co., Dept. ECM,
103 Hawthorn Street,
Hartford 6, Connecticut.



ARROW AH HART

Quality since 1890

WIRING DEVICES · ENCLOSED SWITCHES
APPLIANCE SWITCHES · MOTOR CONTROLS

Ice Capades Inc.

"The Greatest Show on Ice"
specified
SCR® DIMMERS†
by
KLIEGL
The Greatest Dimmers on Earth!

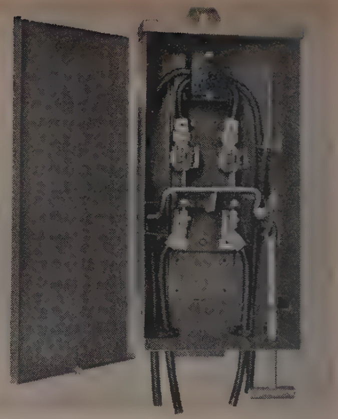
The Kliegl manufactured Stage Manager's "Nerve Center" contains 6 SCR Dimmers (24,000 watt total capacity) for lighting control. In addition, it has controls for curtains and hoists . . . intercommunications system . . . power panel for feeding back-stage electrical equipment . . . in a few words *complete electronic control in a compact portable console.*

Compactness is possible *only* with Kliegl SCR Dimmers and no other dimmer can offer comparable versatility, flexibility and ruggedness.

Contact Kliegl Brothers for complete information on the job-tested SCR method of dimming control.

†PATENTED

lighting
KLIEGL BROS.
UNIVERSAL ELECTRIC STAGE LIGHTING CO., INC.
321 W. 50th ST., NEW YORK 19, N.Y.
ORIGINATORS AND MANUFACTURERS OF KLIEGLIGHTS



Entrance Equipment (34)

Pole-top service entrance with a safety-switch-blade-type disconnect is featured in the new Hi-Liner "KB" series of entrance equipment. Available in six standard models, they incorporate the Westinghouse "Diamond Point" safety switch block. The series is available with either a straight push-pull or toggle type handle and can be locked in either "off" or "on" position. Steel cabinet measures 8 in. by 14 in. by 35 in. and is weatherproof and finished in a bake-on gray enamel. All units are available with a mounted General Magnetics current transformer which is wired for field connection. Series also includes three models of a double pole, double-throw switch. Unit is primarily designed for use on services requiring protection from standby generators used for auxiliary power.

Hi Products, Inc., 2541 S. Louisiana Ave., St. Louis Park 26, Minn.

Switch (35)

A new 100-amp light-duty safety switch with one-piece terminal-contact construction was designed with four parts per pole. The cam mechanism with spring action gives effect of quick make-and-break, insuring positive opening and closing of contacts. Switch is constructed with knife-blade contacts that are fully visible to provide assurance of safety. NEMA 1 enclosure has ample knockouts, with extra-wide gutters providing plenty of wiring space. This 100-amp light-duty safety switch is rated at 240 volts ac and is available as a 2-pole or 3-pole unit with three-wire solid neutral and four-wire solid neutral.

Arrow-Hart & Hegeman Electric Co., Hartford, Conn.

Thermostat (36)

New decorator room thermostat for electric heating. It has the same dimensions as the G-E decorator plates and can be mounted with them so lighting and heating controls are in one location. In brushed aluminum or ivory, thermostat has been designed especially for electric comfort heating systems, including radiant heating wire in the ceiling, baseboard convectors, and wall heaters. They are sensitive to both radiant and air temperature. Range of temperature settings is 55 to 85 deg F. Units are available in single pole with temporary shutdown position, and double pole with off position. All units are high capacity with 5000 watts at 240 volts ac.

General Electric Co., Appliance Park, Louisville 1, Ky.

Product Briefs

(37) Millers Falls Co., Greenfield, Mass., is manufacturing a new **tool**, called Super Saw, which makes straight, curved and circular cuts in practically any material including metal plate, angle iron, pipe, conduits and plastic.

(38) A 7-ft, 10-in. hydraulic **"hot line tool"** is available from Aluminum Co. of America, Pittsburgh, Pa. . . . (39) Arno Adhesive Tapes, Inc., Michigan City, Ind., is producing a new weatherproof plastic electric **tape** which is unaffected by acids, alkalies or oils.

(40) New "800" series **paging** system now housed in a walnut case are available from the Autocall Co., Shelby, Ohio. . . . (41) Molco Drilling Machines, Inc., Washington, D. C., has revised their Model "RV" **Mole machine** which drills 12-in. diameter holes through an 8-in. wall.

(42) A replacement for metal fish tape called rigid **rope** designed for use in any size conduit has been introduced by Jet Line Products, Inc., Charlotte, N. C. . . . (43) The Epoxylite Corp., South El Monte, Calif., announces availability of their **cable accessory** kit No. 715 for making hermetic potheadless terminations on 15-kv paper-lead cable.

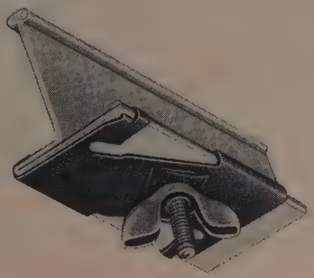
(44) A new plastic **screw anchor** that works equally well in hollow wall or solid materials has been developed by Ace-Sycamore, Inc., Sycamore, Ill. . . . (45) Westinghouse Electric Corp., Lamp Div., Bloomfield, N. J., announces a new line of reflector floodlight bulbs in six different colors.

NEW TWIST-CLIP
Tee BAR HANGER
FOR MOUNTING ELECTRICAL FIXTURES
TO EXPOSED ACOUSTICAL CEILINGS

JUST PUSH UP-
TWIST-

IT'S ON

Pat. Pending
Trade Mark Reg.

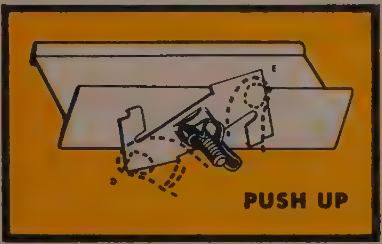


SAVE 50%
OVER OTHER
METHODS

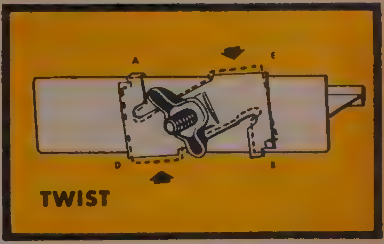
FEATURING:

1. Seconds to install
2. No tools
3. Fits all Tee BAR widths
4. Holding capacity equals that of Tee Bar
   Withstands 400 lbs. straight pull
   Recommended 100 lbs. load (based on 4-1 safety factor)
5. Plated quality spring steel—no corrosion
6. Twist-Clip has ¼"-20 x ⅝" threaded stud. Lock type wing nut included

HOW IT WORKS



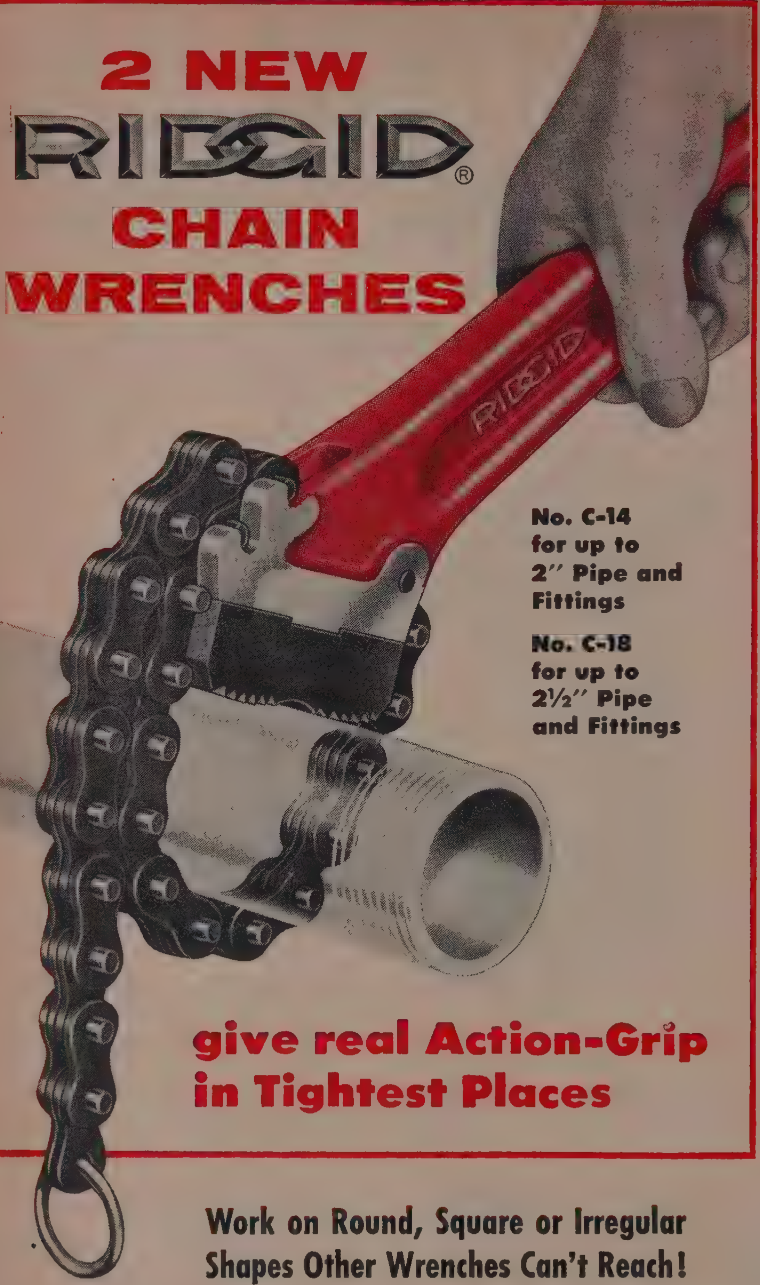
Engage large flanges D&E over opposite sides of Tee Bar. Apply slight pressure as TWIST-CLIP is made of spring steel.



Twist flanges D&E clockwise until small flanges A&B snap over edges. TWIST-CLIP is now in position.

Cat. No. 4-G-16 Packaged 100 per box, shipping wt. 4 lbs.

CADDY. FASTENER Div.
ERICO CADWELD PRODUCTS, INC.
2070 EAST 61st PLACE • CLEVELAND 3, OHIO



2 NEW RIDGID® CHAIN WRENCHES

No. C-14 for up to 2″ Pipe and Fittings

No. C-18 for up to 2½″ Pipe and Fittings

give real Action-Grip in Tightest Places

Work on Round, Square or Irregular Shapes Other Wrenches Can't Reach!

In extra close quarters, there's nothing that'll beat these new RIDGID Chain Wrenches for getting the job done. Fast, ratchet-like action in either direction . . . from either side. Give tight grip without crushing. Large, easy-to-grab end ring for fast chain adjustment. Tempered steel chain locks securely . . . releases quickly. Rugged, comfort-grip, I-beam handle, guaranteed not to break or warp . . . handy hang-up hole.

Light and easy to use, these new RIDGID Chain Wrenches do everything a regular wrench can do . . . and much more. Call your Supply House and get one today!

RIDGID®

The Ridge Tool Company, Elyria, Ohio, U.S.A.

Catalogs & Bulletins

(46) Lighting Unit. 4-page folder features "Quartzlite 500" unit including specifications and accessories. Appleton Electric Co.

(47) Precision Instruments. New data file gives specifications of the complete line of Hermach-Engelhard transfer volt-ammeters. Engelhard Industries, Inc.

(48) Power Resistors. Complete line of high temperature power resistors is described in Bulletin P-7. International Resistance Co.

(49) Aluminum Fittings. Bulletin AL-60 features complete line of aluminum Unilets, junction boxes, accessories, switch covers, receptacles and lighting fixtures. Appleton Electric Co.

(50) Burglar Detection Systems. 12-page brochure describes ultrasonic burglar detection-alarm systems. Kidde Ultrasonic & Detection Alarms Div., Walter Kidde & Co., Inc.

(51) Compact Substations are described in Bulletin 61B9756 entitled "Regu Tran Compact Substation." Allis-Chalmers Mfg. Co.

(52) Power Centers. Bulletin GEA-7080, 12 pages, gives data on Cabinetrol centers which are engineered and custom-built to customer specifications. General Electric Co.

(53) Lighting Units. Complete line of suspended commercial fluorescent lighting units is described in Bulletin C. Benjamin Div., Thomas Industries Inc.

(54) Circuit Breakers. Construction and design features of intermediate outdoor oil circuit breakers (Type FZO) are described in Bulletin 71B8475, "Intermediate Outdoor Oil Circuit Breakers." Allis-Chalmers Mfg. Co.

(55) Earth Anchors. 4-page price and technical Bulletin 760 describes guy wire earth anchors. Pieper-Lillard Div., Jasper Blackburn Corp.

(56) Golf Lighting. Bulletin OLP-1016 provides diagrams and lighting equipment specifications for four sizes of miniature golf courses. General Electric Co.

(57) **Pushbutton Switches.** Two-page data sheet No. 182 covers series of miniaturized lighted pushbutton switches. Micro Switch.

(58) **Distribution Centers.** 20-page Bulletin GEA-6928A discusses advantages of new dry-type integral distribution centers. General Electric Co.

(59) **Bar Hangers.** 4-page Bulletin BH-5 describes three adjustable bar hangers designed for installation in dry wall board and plaster construction. Steel City Electric Co.

(60) **Product Guide.** 10-page condensed electronic/electrical product reference guide covers most frequently ordered products. The Superior Electric Co.

(61) **Motor Protection.** 4-page Bulletin CDS-254 lists advantages of RTV silicone rubber systems for protection of motors subjected to moisture, chemicals, abrasive dust, etc. General Electric Co., Silicone Products Dept.

(62) **Precision Switches.** 32-page Catalog No. 10-1 contains detailed information on expanded line of snap-acting precision switches. Unimax Switch Div., The W. L. Maxson Corp.

(63) **Industrial Power Systems.** Bulletin GEA-7139, 48 pages, outlines principles of planning industrial power distribution systems. General Electric Co.

(64) **Electrical Switches.** 12-page Catalog No. 60 describes entire line of electrical switches for consumer, industrial and military products. Electrical Div., McGill Mfg. Co., Inc.

(65) **Lighting Systems.** Budget Guide and circular slide-rule calculator give description of a large variety of patterns in light diffusers available for Luminous Ceiling lighting systems. Luminous Ceilings Inc.

(66) **Controls.** GEC-1260D.2, 2 pages, second supplement to 72-page catalog GEC-1260D, contains price information, ratings and ordering instructions for the new CR127 pressure switch and CR-127G1 pressure governor. General Electric Co.

(67) **Substations.** Brochure 960 covers transformers and substation equipment and contains specific information on a wide variety of load center and substation models. Sorgel Electric Co.

Have You Tried a RIDGID® Hex Wrench Yet?

the Perfect Mate for your RIDGID Pipe Wrench!

Six Sizes with Maximum Jaw Openings of 1 1/16″, 1 1/2″, 1 3/4″, 2 1/2″, 3 1/2″ and 4 7/8″ across flats.

Finest of All Adjustable Smooth-Jaw Wrenches

MORE GRIPPING POWER... for all nuts. Puts a wrap-around grip on hexes that just won't slip. Because you're pulling with at least three flat sides at once, you'll never round off shoulders. Works on square nuts, unions and flatheads, too. Smooth jaws won't even mar polished or plated surfaces.

RUGGED CONSTRUCTION... built good and solid. Thin but extra-strong jaws slip into tight places. The first time you use a hex wrench you'll know that here's a wrench you'll use for a long, long time. It's every bit as rugged as your familiar RIDGID Pipe Wrench.

RIDGID

No. E-110 Offset Hex Wrench

Big Jaw, Short Handle for Sink and Tub Drain Nuts—Maximum Jaw Opening—2⅝″ across flats

RIDGID

No. E-11 End Hex Wrench

Offset Jaw for Easy Work in Tight Places

Maximum Jaw Opening—1½″ across flats.

From experience you know it's easier to work with the best of tools. Order your RIDGID Hex Wrenches from your Supply House today!

RIDGID®

The Ridge Tool Company, Elyria, Ohio, U.S.A.

TRIANGLE BITUMINOUS FIBER CONDUIT

YOU DON'T NEED GLOVES...

to install TRIANGLE Bituminous Fiber Conduit

PLASTIC COATING PROTECTS THE HANDS

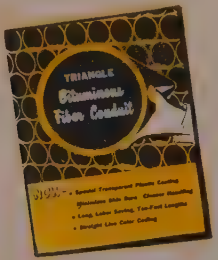
Here's a fiber conduit that's really kind to your hands. TRIANGLE'S special transparent plastic coating keeps this conduit clean, easier to handle . . . minimizes skin burn.

STRAIGHT LINE *COLOR CODE* STRIPE

You identify TRIANGLE Bituminous Fiber Conduit at a glance. A straight color coding stripe runs the length of each section . . . white for Type I, orange for Type II. And, the TRIANGLE seal and type are printed all along the way . . . for easier identification.

LONG TEN-FOOT LENGTHS SAVE TIME AND MONEY

TRIANGLE Bituminous Fiber Conduit comes in long 10 foot lengths (as well as 8 and 5 foot lengths). Longer lengths mean fewer joints, faster installation, lower costs.



***SEND FOR FREE CATALOG**—Illustrated catalog describes features, applications, installation procedures, etc. Yours for the asking by writing:*

TRIANGLE CONDUIT & CABLE CO., INC.

"It MUST Be Right!"

EXECUTIVE OFFICES: NEW BRUNSWICK, N. J.
Plants: New Brunswick, N. J., Landisville, N. J.,
Moundsville, West Va.

Reader's Quiz

QUESTIONS from readers on problems of industrial equipment, installations, maintenance and repairs. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay $5.00.

Grounding Methods

QUESTION W38—We are in the throes of designing a new research building and need an adequate equipment ground throughout the entire building. This ground should interconnect the structural steel. The questions are: What size copper must be used to ground every column? How is this wire connected to the column? Are ground rods needed at each column?—J.M.

ANSWER TO W38—A very effective and reliable way to make permanent ground connections is by the Thermoweld Process and the manufacturer's directions (Burndy Corp.) should be carefully followed. See ad in E.C.&M., Oct. 1960, page 41. As an alternative drill hole into column and attach a suitable ground connector. If column cannot be drilled, butt weld 2 in. by 2 in. by ¼ in. iron clip to column for ground connection.

Ground rods are not required at each column. Run a ground loop around the building and connect to columns.

Use No. 2/0 ground cable, unless NEC Tables 250-94a -94b, -95 or special conditions require larger size.

A good grounding system of this type was described in E.C.&M., Nov. 1959 issue, as installed for the National Bank of Detroit.

An excellent article on grounding, written in easy to understand form is "Fundamentals of Equipment Grounding Circuit Design." It appeared in *Application & Industry* Nov. 1954, published by American Inst. of Electrical Enginers.—J.A.

ANSWER TO W38—It is usually not necessary to make special provisions for an equipment ground in a building. A properly designed electric system includes an adequate equipment ground, either by virtue of the bonding of the metallic raceways themselves or (preferably, in my opinion) by use of separate grounding conductors carried within the raceways. Any system which depended for safety on current flowing through the building structure, outside the raceways, would be potentially hazardous. It is not even necessary that all parts of a building be connected to the earth in order to avoid shock hazards. It is only necessary that all parts of the building which are accessible be at the same potential. For instance, we drive about in automobiles, which have 15 kv ignition systems, while effectively insulated from the earth by rubber tires.

It is not necessary to interconnect the structural steel in a building. After all, steel has approximately one-seventh the conductivity of copper—the large cross section of steel members and the physical size of high pressures used in connections more than make up for any apparent advantage in copper's high conductivity. If we are going to recognize soil as a conductor (when we drive ground rods in it) we certainly ought to recognize steel. Whether the building steel is interconnected or not, it would be wrong to depend on the building steel to carry stray current. There is no reason for current to flow through a building's structure if the electric system complies with the NEC requirements.

It is not necessary to ground columns or make a special effort to connect them to the earth. No one would advocate a general attempt to insulate a building from the earth, but the grounding of the electric system raceway (preferably to a metallic water line) is sufficient to suppress any hazardous potentials which might result from failures in the power system or induced static, or lightning discharges to the building. It would be difficult to design building foundations and column supports which were inadequate from a lightning and static standpoint. Copper grounds on steel columns do not contribute to safety, and in most cases, their only effect is to increase the corrosion rate of the steel through formation of a galvanic cell. It is possible to create a tripping hazard—there just aren't any benefits.

I realize my comments are going to be regarded as heresy by some. I happen to believe now is as good a time as any to look closely at our grounding practices and decide which are based on witchcraft or blind fear and which are founded on honest thought and good sound engineering.—R.L.M.

ANSWER TO W38—You are very wise to give early consideration to a good underground grounding network, particularly in a research building.

Following are my recommendations to your three questions:

1. I am sure you would find an AWG 4/0 bare, stranded copper cable quite adequate for your grounding requirements.

2. From experience, I would recommend only a thermite type weld connection for connecting to building columns and to driven ground rods. I would use this method even for conductor-to-conductor splicing. The "Cadweld Process" is the type we are using very successfully.

3. Your third question is a little more difficult to answer briefly; however, the following "rules of thumb" should serve as a guide.

One accepted method of grounding to earth is by use of driven ground rods supplemented by an underground water piping system, if available. For a good ground system, you usually do not want to exceed two ohms to ground.

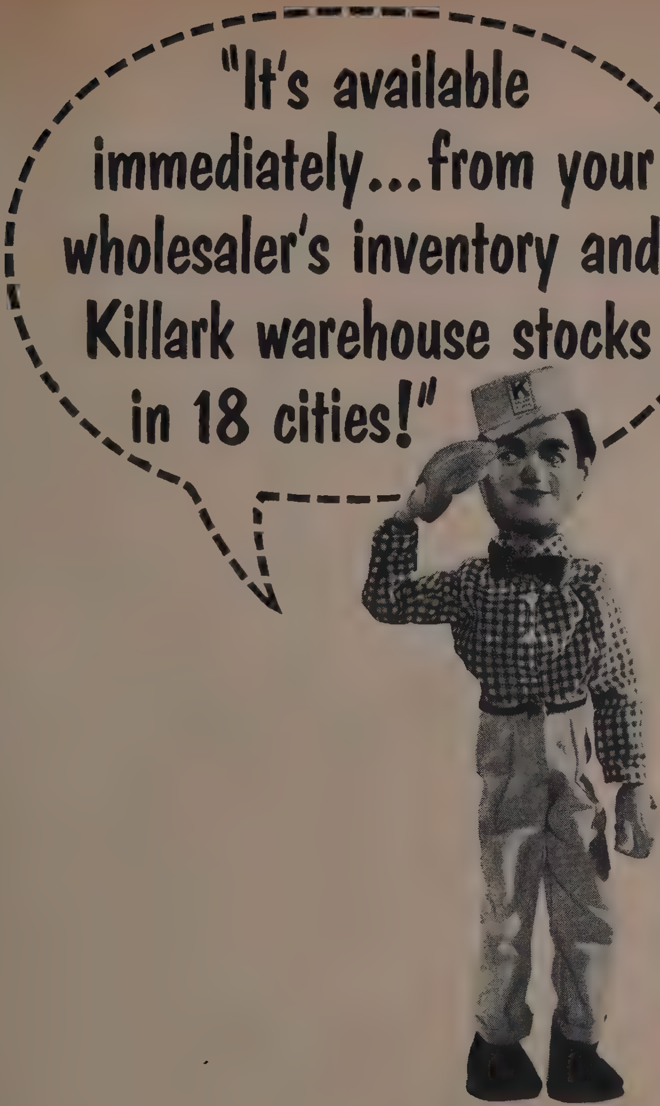
Depending on soil conditions and the size of the building, it is not generally required to drive a ground rod at each column. For reasonably good conductive ground conditions, it is not necessary to drive rods more than every 100 to 200 ft along the outside building columns. Each water main entering the building, if suitable for use as a ground, should be connected to the ground bus at a minimum of two points.—I.G.B.

Exciter Capacity

QUESTION X38—Suppose we are planning to add a 1500-kva turbo-unit to our 3000-kva generating equipment, and also wish to install a synchronous condenser to improve our power factor, now only about 70%. What should be the capacity of the exciter to supply both the new generating unit and the condenser?—G.J.P.

ANSWER TO X38—This is an intriguing question. I think more information will have to be furnished before it can be adequately answered.

"How fast can it* be delivered?"


"It's available immediately...from your wholesaler's inventory and Killark warehouse stocks in 18 cities!"
K

Killark distributors can usually deliver all electrical fittings and fixture requirements from inventory. If not, your needs from the more than 7,500 items in the Killark line can be obtained *at once* from a convenient Killark warehouse. There are eighteen of these dependable supply sources located throughout the United States and Canada.

* KILLARK XALB-6 EXPLOSION-PROOF PULLING ELBOW . . . Copper-free aluminum casting, permanently rust-proof and corrosion resistant, non-magnetic and non-sparking. Split design provides easy access to wiring; ribbed for greater strength. U.L. and C.S.A. approved. Carried in stock for fast delivery, a typical example of Killark's ability to supply all your needs—large and small—for both hazardous and non-hazardous installations.

Write for the Killark catalogs.

Killark

ELECTRIC MANUFACTURING COMPANY
Vandeventer and Easton Ave. • St. Louis 13, Missouri

In Canada: Killark Electric of Canada, Ltd., 421 Islington Ave. South, Toronto 18, Ont.

6101

pick your fish tape to fit your job

Have a tough wire fishing job? Don't fight it! Ideal fishing equipment makes any job smooth and easy.

Fairly straight and simple runs? All you need is an Ideal flat fish tape. These tough and flexible tapes are made of oil tempered spring steel. 1/8″ and 1/4″ sizes in 50, 100 and 200-foot lengths, with preformed hook at each end.

Save your hands! All Ideal tapes are available in the unique puller-reel that holds tape under tight control so it can't spring loose. This sturdy steel reel with smooth, rounded edges also gives you a man-size grip for pulling through the tough runs.

Hanging up on too many bends? Snake your way through all kinds of bends and els by adding an Ideal Flexible Leader to the front of your tape. Music wire spring wound around a 20″ airplane cable makes pushing easy. Tested for 400 lb. pull. Eye takes up to six #10 wires. Other end screws tight into fish tape ball.

also...

COIL-FLEX. Here is a 25-foot version of the Ideal flexible leader. Use it as a fish tape to get through those impossibly tricky conduit runs. Goes around any bends without snagging or cutting. For long jobs, screw several together, or attach as an extra long leader for your regular fish tape.

NYLON INSULATED. Rugged Nylon insulation on round fish tape gives added protection when working in live panel boards and other "hot" equipment. For use in ¾″ and smaller conduit. 50, 100, and 200-foot lengths with swivel ball on end.

Write for FREE Contractor & Electrician Catalog. It contains full descriptions of the complete Ideal line of electricians' equipment.

IDEAL

IDEAL INDUSTRIES, Inc.
5224-B Park Avenue, Sycamore, Illinois
Sold through America's leading distributors
In Canada: Irving Smith, Ltd., Montreal

The first question that pops into my mind is, what are we talking about in machine capacities? Is our base 3000 kva, or 4500 kva? Power factor 70% to be corrected to what? With a base of 4500 kva, correcting from 70% power factor to 90% power factor will require about 2250 kva, reactive. The next significant question is, how much overload will the units be required to carry? Excitation requirements increase rapidly with overload, or, with low bus voltage.

However, if a condenser is to be purchased, then it should have a separate source of excitation. With a single source of excitation, for two or more units, trouble with the source of excitation, or with the circuits, could shut down the units excited from the common source. The cost of providing two exciters as against the total cost of the two new units would be insignificant.

Separate sources of excitation for the two generating units and the condenser could materially reduce the cost of the installation, providing a generating unit could always be shut down whenever it was necessary to start the condenser.

However, if cost is an item, then serious consideration should be given to the installation of static capacitors, in small blocks, rather than a condenser.

A condenser, per kva, is more expensive than the same capacity in capacitors. It is costly to ship, handle, install (requiring a foundation and considerable floor space), operate and maintain. Control, whether manual or automatic, is also expensive to purchase, install and maintain. Switchgear, metering and relaying will likewise be required. Power losses, a minor matter with capacitors, will be a large item with a condenser.

With the condenser down, all corrective kva will be lost. Capacitors can be installed in small blocks, directly connected to the terminals of motors, or other devices. The capacitors can be switched with the devices to which they are connected, making it unnecessary to purchase additional switchgear. This will have the additional advantage of simplifying the problem of maintaining system voltage at a constant level.

The condenser will supply a block of reactive kva at one location so that the distribution circuits will have to carry reactive as well as active power. Locating capacitors directly at the load will unload the distribution circuits, making it possible to add load without increas-

ONLY VISIBLE BLADES GIVE YOU SAFETY YOU CAN SEE!

● The men who pull the switches will tell you what can happen when a switch, *believed* to be open —*isn't*. A lot of things can happen—and every one of them is bad. Personnel safety is in jeopardy. Motors can single-phase. Machinery and work can be damaged. Down-time can skyrocket.

Doesn't it make sense to insist on **V**isible **B**lade construction which gives you a road block against any of those possibilities? Doesn't it make equally good sense to insist on the safety switch which gives you that construction—plus a lot of other performance advantages? Evidently it does, because *Square D switches have never been out of first place in more than 50 years!*

They cost no more...why settle for less?

MAIL the coupon for latest Safety Switch Bulletin

Square D Company, Dept. SA-131
1601 Mercer Road, Lexington, Kentucky

Please send me your latest SAFETY SWITCH BULLETIN

NAME________________________________

COMPANY________________________________

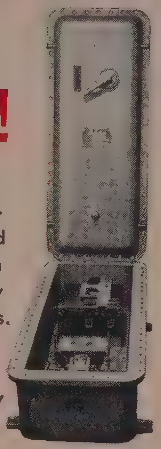
ADDRESS________________________________

CITY________________ZONE____STATE__________

SQUARE D COMPANY

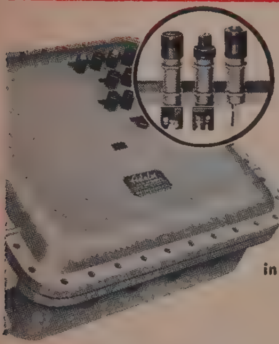
wherever electricity is distributed and controlled

UL-Listed EXPLOSION-PROOF Stock Housings!



If your equipment has to be explosion-proof, use a standard Adalet cast aluminum housing . . . already listed by Underwriters. It can save "examination" time and eliminate unnecessary design cost.

Stock UL-listed housing adapted with 400 amp. thermal-trip breaker and motor starter. Note breaker reset handle on cover.



Stock 24" x 24" x 8" housing adapted with pilot lights and selector switches mounted in hinged cover.

Stock 12" x 18" x 6" UL-listed housing adapted with a window for oscilloscope.

Request Explosion-Proof Bulletin 160

Most Adalet Explosion-Proof Housings are immediately available from stock.

Adalet CAST-ALUMINUM WEATHER-PROOF and EXPLOSION-PROOF HOUSINGS

THE Adalet MANUFACTURING COMPANY

14300 Lorain Avenue / Cleveland 11, Ohio

ing the size of exciting conductors.

These are purely generalities. Much additional information would have to be provided to determine the proper solution.—J.B.P.

ANSWER TO X38—It is possible to supply the excitation requirements of two synchronous machines from one dc exciter. The alternator and condenser should preferably have nearly equal rated load field voltages. In any case, the exciter voltage rating should be 125% of the highest rated load field voltage and the current rating should be 125% of the sum of the rated load-excitation currents required for each machine. The product of 125% voltage and 125% current gives the exciter kw and the standard size at least equal to that kw should be chosen. Each synchronous machine will, of course, require its own field rheostat.

If the exciter is driven by the alternator shaft (usually the most reliable arrangement), it will not be possible to run the condenser unless the alternator is running. If the generating station has a sufficiently reliable station service, it may be preferable to use a static exciter (silicon rectifier) preferably fed from a manually regulated ac supply (100-80% output voltage). This is less costly than a rotating machine, it eliminates brush maintenance, etc., and the ac supply regulator to the exciter will at least minimize the power which must be wasted in the field rheostats in order to control station voltage and kvar load division effectively.

The above arrangements require bulky rheostats, waste a lot of power in the field control circuits, and are so cumbersome to control automatically with conventional generator (or condenser) voltage regulators that the scheme should not even be considered unless one is content with hand control over station voltage and kvar division. Standard controls which can be economically applied to small machines are set up for an individual exciter for each machine since that is usually the most satisfactory arrangement.

The general proposition of installing a 1500-kva turbo-alternator and at the same time "add a synchronous condenser to improve our power factor" is possible, but is not likely to be practical. In a generating station, it is possible to shift the magnetizing burden (variously called kvar, rkva, lagging kva or "reactive") from one synchronous machine (alternator or condenser) to another but it is not possible to alter the power factor of the load in any way by adding generating station equipment. The "load" power factor may be improved by adding a condenser or (preferably) capacitors *at the load,* but a condenser at the power plant is simply a new source of supply for the heavy magnetizing current required by the low power-factor load.

If it is decided to carry the 0.70 power factor load with only power station synchronous machines (no capacitors), it is most economical and efficient to allow the alternators to carry both the kw and kvar loads. For instance, to carry a 1200-kw 0.7 PF load would require a 1200-kw, 0.8 PF (1500-kva) generator and a 326-kvar synchronous condenser, a total of 1500 plus 326 or 1826 kva of machines. The same load could be carried either by a 1200-kw, 0.7 PF, 1715-kva generator or a 1500-kw, 0.8 PF, 1875-kva generator. Either way, the larger generator will cost less to buy and have much lower running losses than the generator-condenser combination. It should be remembered that the power factor of a small synchronous condenser is about 3%, which means 3% of its rating plus its excitation is kilowatts lost. The power factor of capacitors is on the order of 0.01%, and losses are insignificant.—R.L.M.

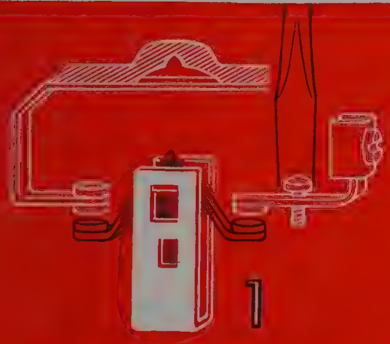
Air Conditioner Ratings

QUESTION Y38—*I am rather puzzled regarding rating of air conditioning units which we have on the market in Canada. These units are mostly for installation in windows. According to our technical publications and understanding 1 hp is equal to 2545 Btu per hour. However, I find on the market a 1 hp air conditioner with a rating of 6700 Btu and 7½ amps at 115 volts. What confuses me is 7½ amps; according to Table 41 of the C. E. Code this is very near ½ hp which is rated at 7.4 amps and this would certainly not furnish a 1-hp air conditioner. I find in another case a 1-hp air conditioner with a rating of 8600 Btu and 12 amps at 115 volts. According to CSA, ¾ hp has a rating of 13 amps. Therefore, the rating of this air conditioner must be slightly less than ¾ hp. In making inquiries I am advised that the NEMA rating for 1 hp is 12,000 Btu.*

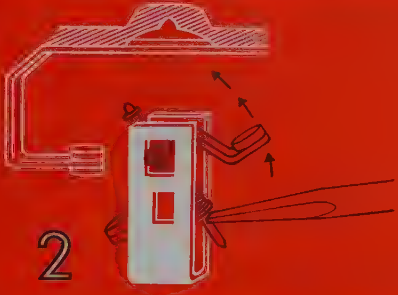
With all these confusing ratings I am certainly at a loss. During

Four simple steps to contact changeover

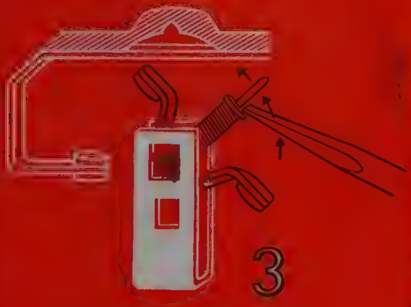
Total time—not more than 60 seconds



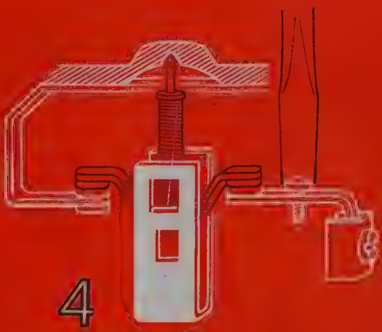
REMOVE FRONT STATIONARY TERMINAL



LIFT CONTACT SPRING AND ROTATE



DEPRESS SPRING AND
TURN PIN STRAIGHT UP



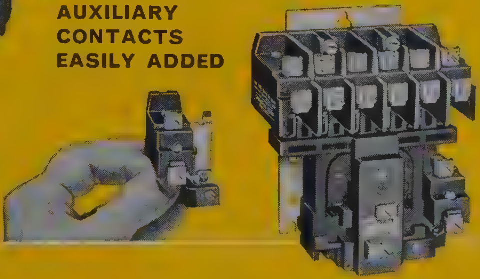
REPLACE TERMINAL
IN REVERSE DIRECTION

Converts from N.O. to N.C. (or vice versa) in 60 SECONDS!

You'll be truly amazed at the ease of converting the contacts on these Allen-Bradley Bulletin 700 Type BR relays. Using only a screwdriver, as shown above, the contacts can be changed from N.O. to N.C. (or vice versa) in four easy steps—that take only *60 seconds!* Such convenient flexibility is a "natural" for reducing relay inventories.

The Type BR relays are built to provide *many millions* of trouble free operations. With the built-in permanent air gap, magnetic sticking is impossible. And the molded coil is impervious to *all* harmful atmospheres. Of course, the double break, silver contacts *never* need attention. If you use relays, there are money savings for you in the Type BR relay line!

**AUXILIARY
CONTACTS
EASILY ADDED**



Type BR relays are available with 2, 3, 4, or 6 poles—but as a valuable bonus, one or two fully rated poles can be added to the base of each relay—even in the field. It's a simple addition that takes only moments.

ALLEN-BRADLEY

Member of NEMA

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis. • In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

***QUALITY
MOTOR
CONTROL***

5-61-RM

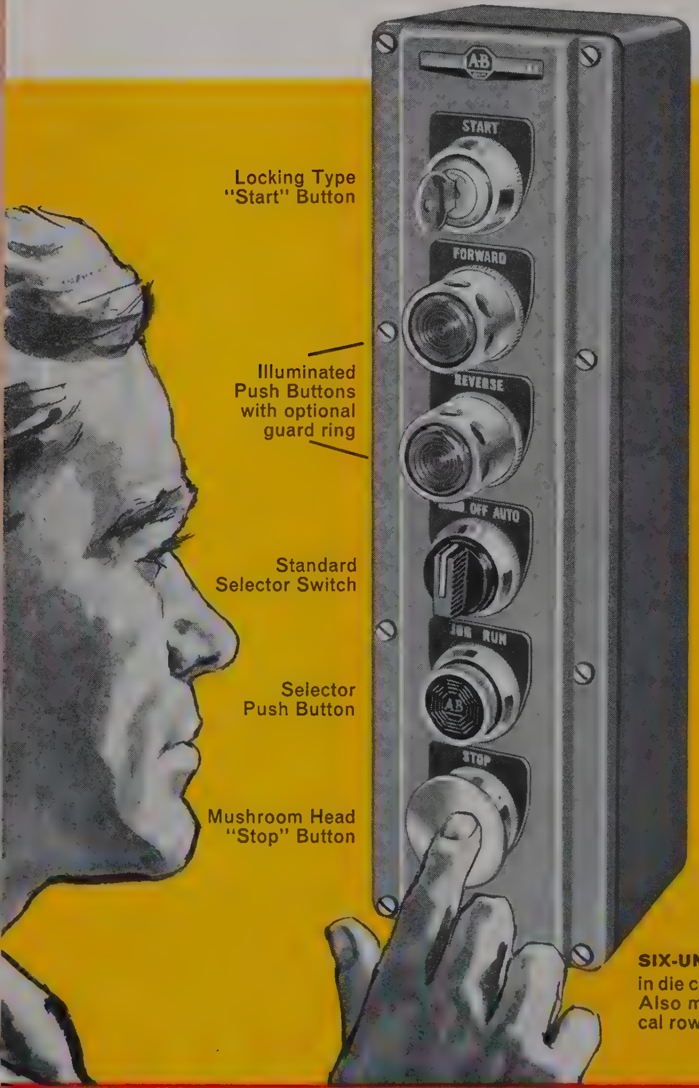
A-B QUALITY

BE *SURE* YOU GET

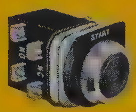
Quality Appearance Quality Operation

Specify Allen-Bradley's line of OILTIGHT CONTROL STATIONS

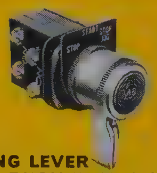
Allen-Bradley oiltight units and stations harmonize with the trim lines of modern machine tools—they look as if they were a part of the machine. Also, from the wide selection of control units, you'll be able to satisfy every operating requirement. A-B control units are positively oiltight—impossible for oils and cutting fluids to foul the contacts. And the silver contacts assure reliable operation. The rugged construction and generous wiring room of all A-B stations are valued by the installation engineer. Insist on Allen-Bradley pilot control units and stations—you can't make a mistake! Send for Publication 6090.


Locking Type "Start" Button
Illuminated Push Buttons with optional guard ring
Standard Selector Switch
Selector Push Button
Mushroom Head "Stop" Button
START
FORWARD
REVERSE
OFF AUTO
JOG RUN
STOP

SIX-UNIT CONTROL STATION
in die cast aluminum housing. Also made with up to 4 vertical rows with 4 units per row.

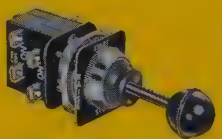


FLUSH HEAD
push button, also made with extended head.



WING LEVER PUSH BUTTON
Combines push button and selector switch.

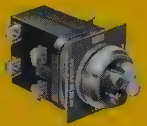
PUSH-TO-TEST PILOT LIGHT
Six different color lenses available.



4-WAY SELECTOR SWITCH
Also furnished for 2-way operation.

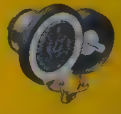
PILOT LIGHT
Transformer or full voltage types.

DOUBLE CIRCUIT
Has 2 N.O. or 2 N.C. sets of contacts.



PILOT LIGHT CLUSTER
Four lights of different colors in one unit.

SELECTOR SWITCH
With coin slot operator. Other operators available.



CONVENIENCE RECEPTACLE
For plugging in work light or small tools.

SPECIAL CONTROL CONSOLES
can be furnished to meet your exact operating requirements.

ALLEN-BRADLEY

member of NEMA

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis. • In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

QUALITY MOTOR CONTROL

my past education I was taught that 1 hp was equal to so many Btu—2545 per hour.

It would be very much appreciated if you would have your readers explain to me how these different ratings are arrived at, or are they simply selling gadgets to the public.—J.S.B.

ANSWER TO Y38—You are confusing 1 hp of heat with 1 hp of work required to circulate and compress a refrigerant. You will drive yourself crazy doing that.

True 1 hp = 746 watts = 2545 Btu, dealing strictly with electric energy in terms of heat.

Now in terms of refrigeration, it is commonly accepted (roughly) that 1 hp is required to drive a 1-ton machine, hence the 1 hp for 12,000 Btu. One ton of refrigeration of cooling = 12,000 Btu/hr which is quite a bit more than the 2545.

The gas from a 1-ton machine is compressed and on evaporating it picks up 12,000 Btu. This heat is given up somewhere. So in the process of compression of the gas and in liquefying it, the heat is given up either to the air or to cooling water. The 1-hp motor only compresses and circulates the gas. You would have to set up a complete heat balance equation to account for all the 12,000 Btu, taking into account air circulation and/or water for cooling (or compressing) the compressed refrigerant.

This commonly accepted figure of 1 hp for 1 ton depends again on the condensing pressure of the gas used. Different gases condensing at different pressures require different power requirements.

Each manufacturer has his own way of rating his unit. Another thing, the motors used are generally special jobs and to get a high hp with a low current the power factor has to be high. You can't use the normal rating found in the code book because it doesn't work. Some of the manufacturers' figures could be selling gadgets.—W.E.G.

ANSWER TO Y38—The Btu ratings listed refer to the amount of heat the air conditioner can remove from your home. The machine adds to this the equivalent of the electric energy being consumed by the motor and dissipates this total outside. There is no one-to-one relation between either horsepower or watt input and the Btu rating.

Horsepower ratings of small motors are determined from torque and speed in accordance with NEMA standards. There is only a rough correspondence between any small motor's rating and its actual horsepower. In an air conditioner, the motor is cooled by the refrigerant; and since the motor cannot very well burn out, the designer has lots of elbow room on how much load he places on it. I am sure it would be possible to design an air conditioner with a $\frac{1}{2}$-hp motor which did a better job than some "1-hp" units. After all, the important considerations are how much cooling does the unit do, how many watts (not amperes) does it draw per Btu, does it dehumidify, will it cool when it's hot outside or only when it's cool, is it quiet, well made, will it last?

If your 7.5-amp air conditioner draws only about 7.5 amps, evidently the power required by the air conditioner compressor is less than 1 hp. This infers a big motor in a little air conditioner—the manufacturer is under no obligation to load up the motor. The current drawn also varies with the temperature conditions. As to the code figures on motors—these were decided in conference and bear little or no relation to reality.

All in all, I think the air conditioning industry has done a fair job on policing itself and trying to be honest with the public.—R.L.M.

CAN YOU ANSWER These QUESTIONS

QUESTION H39—There are a number of cases where it is desired to measure the resistance of the motor winding while the motor is energized. One case that occurred in our plant was where the variation in temperature of the motor winding was to be recorded while the motor was operating. I would appreciate it if someone could advise the best method of doing this. The motor in question is a $\frac{1}{4}$-hp 115-volt, single-phase motor.—H.H.S.

QUESTION J39—We are planning on installing some large motors in a section of our plant and have a 2.4 kv available, but can also obtain 4160 volts for these motors from available transformers. I am interested in knowing what the considerations are in deciding which of these two voltages to use.—R.E.B.

PLEASE SEND IN YOUR ANSWERS BY MARCH 15

weather-proof everlasting protected lighting

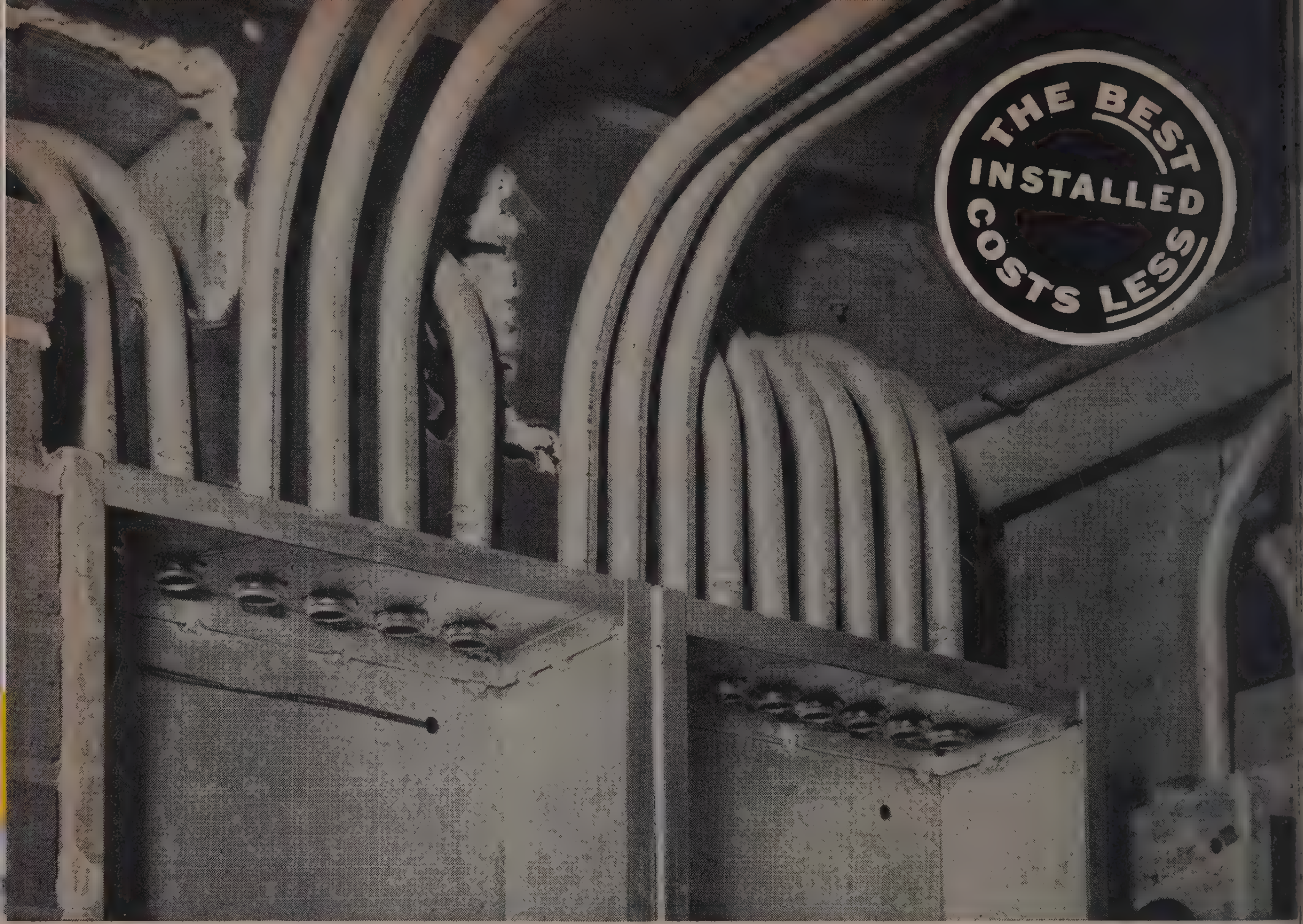
82-84
square round
lines
by mc Philben

Exterior and interior ceiling surface applications under CANOPIES, MARQUES, in SHOWER ROOMS, CORRIDORS, VESTIBULES, ALL PURPOSE ROOMS, LOBBIES, SHOPPING CENTERS. Absolute security application in PSYCHIATRIC HOSPITALS, PRISON CELLS, CHILDREN SHELTERS.

82 and 84 lines feature:
- ALL CAST ALUMINUM, sturdy, 2 piece construction in both guarded and non guarded units with integral cast hinge. Extra heavy .156 inch wall thickness.
- VAPORTIGHT (enclosed and gasketed), BUGTIGHT, WEATHERPROOF performance.
- mcPhilben's EVERLASTING ANODIZED satin aluminum finish, for permanent protection against corrosive elements.
- CHOICE of diffusers: Holophane prismatic Controlens,® tempered Fresnel Lens, heavy molded Carrara glass, or Herculite (for high security applications)

Complete specification data sheets on request Section A pages 9-10/9a-10a

mc Philben
LIGHTING
1329 Willoughby Ave., Brooklyn 37, N. Y.



"We are pleased to recommend ELECTRUNITE to anyone who wishes to make neater installations at lower cost", were the remarks of S. W. Todd, Todd Electric Company, electrical contractor in the construction of the beautiful Carousel Motel, Houston, Texas. Architect: William Tamminga; General Contractor: South Texas Building Company. Mr. Todd further said, "SILVERSLICK inside finish makes wire pulling easier, "INCH-MARKS" and the straight line ("GUIDE-LINES") the length of the tubing make it easier to make bends and saddles without getting them out of line." ELECTRUNITE will save time and money for you, too. Try it on your next job.

Electricity is service – ELECTRUNITE ELECTRICAL METALLIC TUBING AND REPUBLIC RIGID STEEL CONDUIT *...keeps it modern*

The job is easier, goes in faster, and at a profit, when you use Republic Electrical Conduit Products —quality products that help solve installation problems.

ELECTRUNITE *Electrical Metallic Tubing* is modern today, still modern tomorrow. Strong, sturdy, with the durability you get in steel, yet lightweight, easy to handle. Simply measure for length and use the "INCH-MARKS"® for easy, accurate cutting. Full length "GUIDE-LINES"® are a guide to true wrinkle-free bends everytime. "INSIDE-KNURLING" with SILVERSLICK® finish makes wire pulling up to 37% easier, wire pushing easier, too.

Republic Rigid Steel Conduit pays off in lower installation costs because of its uniformity, ductility, and freedom from hard spots. Easy to use, with clean, sharp, free-running threads, and clean inside surface. Tight, hot-dipped galvanized finish will not flake, peel, or chip off. And, steel is compatible with other building products, even in concrete.

Republic ELECTRUNITE *"Dekoron-Coated"* Electrical Metallic Tubing and "Dekoron-Coated" Rigid Steel Conduit is protected end-to-end with a tough coating of polyethylene that resists fumes, dust, gases, and chemical action in corrosive service. Outlasts standard conduit 10-to-1.

Specify Republic Electrical Conduit Products for your next job. See for yourself how much better the job goes. You'll find, the *best* costs *less* installed. See your electrical distributor today.

ELECTRUNITE

COMPLETE LINE . . . REPUBLIC ELECTRICAL CONDUIT PRODUCTS

ALVITE® RIGID STEEL CONDUIT (Blue Label) is a heavy
vall hot-dipped galvanized conduit with a special coat
f baked-on lacquer inside and out for greater corrosion
esistance and long life.

NAMELITE® RIGID STEEL CONDUIT (Red Label) heavy wall
onduit is protected inside and out with a baked-on coat-
ng of tough, wear-resistant enamel for greater protection
gainst moderate corrosive action.

REPUBLIC "DEKORON®-COATED" E.M.T. is the plastic armored raceway recommended for use in severe corrosive conditions of service. Outlasts standard conduit 10-to-1. Easy to install, requires no special tools, no special fittings.

"DEKORON-COATED" RIGID STEEL CONDUIT is the heavy wall raceway that shrugs off corrosion. Tough coating of polyethylene encases Galvite Rigid Steel Conduit in an end-to-end armor for protection in severe corrosive conditions of service.

REPUBLIC BENDING TOOLS are designed and engineered to help the contractor make accurate, predetermined bends in Republic Electrical Metallic Tubing installations. Avoid costly "wows", wasted time, and wasted materials. Send for *The Bending System* booklet.

ELECTRUNITE

Compatibility and strength characterize raceways made of Galvanized Steel

NATIONAL ELECTRICAL WEEK
FEB. 5-11, 1961

REPUBLIC STEEL
World's Widest Range of Standard Steels and Steel Products

REPUBLIC STEEL

REPUBLIC STEEL CORPORATION
DEPT. EC-1685
1441 REPUBLIC BUILDING • CLEVELAND 1, OHIO

Please send additional information on the following products:
☐ ELECTRUNITE® E.M.T. ☐ GALVITE Rigid Steel Conduit
☐ "DEKORON®-COATED" E.M.T.
☐ "DEKORON-COATED" Rigid Steel Conduit
☐ ENAMELITE Rigid Steel Conduit
☐ "THE BENDING SYSTEM" Booklet

Name__________ Title__________
Firm__________
Address__________
City__________ Zone_____ State__________

Questions on the Code

Answered by:

B. A. McDONALD, *New York Board of Fire Underwriters, Rochester, N. Y.*
B. Z. SEGALL, *Consulting Electrical Engineer, New Orleans, La.*
R. E. WARD, *Chief Electrical Inspector, Insurance Department, State of Tennessee, Nashville, Tenn.*

Dwelling Receptacles

Q. *A dwelling contains rooms having two or more small usable wall spaces exceeding 2 ft with doors and doorways intervening between each of the spaces. Is the intent of Paragraph 210-22(b) to require that receptacles be installed in each of these small spaces, regardless of the proximity of receptacles that may be within 6 ft of such locations?—A.M.*

A. Yes. These small wall spaces have been a real headache for the electrical inspector. These short sections of wall areas are becoming more prevalent in homes. Invariably they are selected for the placement of a table or other piece of furniture with a lamp, radio, television set or clock. Before this rule was put into effect in the code, the homeowner would use extension cords and other makeshift and hazardous wiring to get from the nearest available receptacle, usually not installed in these short sections of wall area, to this electrical equipment. This wiring would be strung along the floor, under rugs, tacked to the door frames, etc., and in general resulted in both a physical hazard—causing tripping—and an electrical hazard—the electrical wiring insulation would break down or even become overloaded and cause the wires to "short circuit."

Experience has shown that each of these short wall spaces should be provided with a receptacle. There are some exceptions such as a door opening into this area and precluding the use of it for anything. Most inspectors are enforcing this requirement on the basis that each section should have an outlet.—B.Z.S.—2/61/1

Licensing Conference Planned

"In an effort to promote uniform standards for the qualifying and licensing of electrical installation personnel, the matter of State-wide licensing becomes a consideration. Several states, including Michigan, have some form of legislation covering electrical licensing and inspection service.

"It is the feeling of some administrators that a meeting of representatives from each existing state agency, and others that may be considering such legislation, should meet at some central point (possibly Chicago) for the exchange of experience and ideas in the hope that results beneficial to the public and the electrical industry may be adopted. Such a meeting is being planned for early 1961. Interested persons may write Ray Rider, Director, Electrical Administrative Board, 531 South Capital Ave., Lansing 33, Mich., for date and place of meeting."—Ray Rider

Rigid Metal Conduit Water Pipe

Q. *In the September issue you discuss the use of galvanized water pipe as conduit. You sum up the article by saying, "In addition to the foregoing, there are several very good reasons why galvanized water pipe, and fittings are not suitable as a raceway for conductors." What are these reasons?*

Also does Section 346-13(b), as referred to in your answer prohibit welding of fittings and boxes? If so, does any other section of the code prohibit "field welding" of fittings?—E.K.

A. My previous comment on the above subject concerned NEC rules, and O. I. No. 150, which indicated that galvanized water pipe is not recognized by the code as suitable for use as a conduit containing electrical conductors.

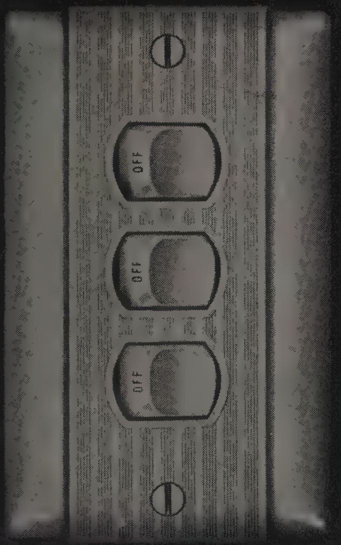
A conduit suitable for use as a wiring method must have smooth interior surfaces, free from burrs. This is essential if we wish to avoid damage to the conductors when they are being installed. As a result, the inside surface is covered with zinc, enamel or equivalent coatings which provide a smooth surface, and also provides a corrosion-resistant coating. Electrical conduit must pass rigid tests to assure no opening or cracks in the weld, and the protective coatings must be sufficiently elastic to prevent their cracking or flaking off when subject to bending. According to the provisions of Section 346-1 of the code, the question of corrosion is covered, as it concerns conduit and fittings. The thickness of zinc coating sufficient to withstand corrosion is a matter of importance. The quality of enamel coating is likewise a question of significance. Conduits exposed to severe corrosive influences shall be of corrosion-resistant material. This code rule is often considered satisfied when an exterior coat of plastic is applied to a zinc-coated ferrous conduit. Rigid electrical conduit is also subject to a standard which concerns the dimensions and weight for a given trade-size conduit. It also must comply with requirements concerning threads, pitch diameter, taper per foot, etc. I doubt that an ordinary water pipe would be able to satisfy the requirements of UL or the NEMA Standard which governs the construction of rigid conduit.

The provisions of Section 346-13(b) do not concern welding. Section 110-14 recognizes welding as a method of splicing conductors. The provisions of Section 300-10 touch on your question. It is quoted as follows:

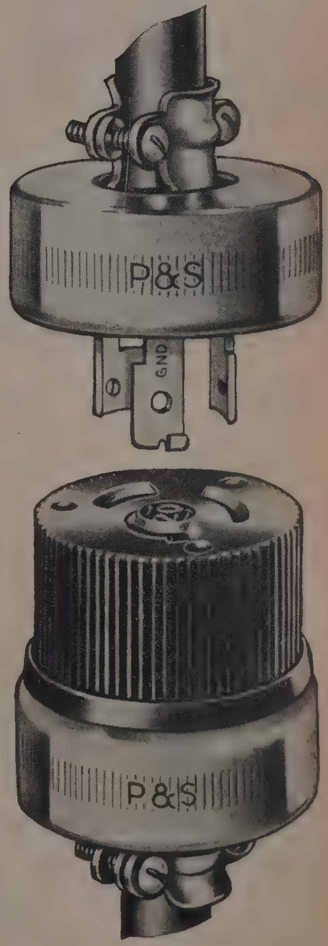
"Electrical Continuity of Metal Raceways and Enclosures. Metal raceways, cable armor, and other metal enclosures for conductors, shall be metallically joined together into a continuous electrical conductor, and shall be so connected to all boxes, fittings and cabinets as to provide effective electrical continuity. Raceways and cable assemblies shall be mechanically secured to boxes, fittings, cabinets and other enclosures, except as provided for non-metallic boxes in Section 370-7."

The phrase, "Raceways and cable assemblies shall be mechanically secured to boxes, fittings, cabinets

P&S means ROCKER-GLO



and TURNLOK too! . . .



The same engineering know-how that goes into the manufacture of world-famous *Rocker-Glo* switches, makes *Turnlok* wiring devices supreme in their field, too. On heavy duty devices or residential, the *P&S* mark is your guarantee of the best your money can buy.

PERFORMANCE SPECIFIED

For free information about *Turnlok* and *Rocker-Glo*

write Dept. ECM 261

P&S®

PASS & SEYMOUR, INC.
SYRACUSE 9, NEW YORK

60 E. 42nd St., New York 17, N.Y. 1440 N. Pulaski Rd., Chicago 51, Ill. In Canada: Renfrew Electric Co., Ltd., Toronto, Ontario

Now Available... the EASIEST CLINCHING fitting in the industry!

ETP INDENTER COUPLINGS & CONNECTORS

- Special Soft Steel for Easy Crimping
- Solid One Piece
- Rolled Thread
- Concrete Tight
- Competitively Priced
- ½", ¾", and 1" Sizes.

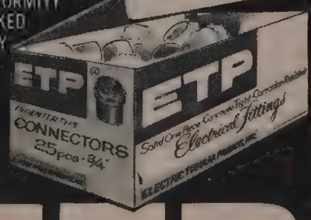
ETP makes clinching easy with this new type coupling and connector. **A dead soft steel**—especially formulated and processed —is used for easy crimping.

- Precision rolled thread for 65% greater strength.
- One-piece solid tubular steel — cannot open or spread.
- Sparkling corrosion-resistant zinc chromate overplating.
- Far exceeds requirements of UL file card No. 24788.

CONNECT WITH ETP FOR ECONOMY!

WRITE TODAY FOR SAMPLES AND PRICE LIST

INDIVIDUALLY TESTED FOR UNIFORMITY AND PACKED IN HANDY EASY-TO-IDENTIFY BOXES



ETP

ELECTRICAL TUBULAR PRODUCTS

74-16 GRAND AVE., MASPETH (N.Y.C.), N.Y.
DEfender 5-8000

and other enclosures," is very general in nature since it does not cover the recognized methods of securing a raceway to a box. As a result, a question arises with respect to a welded connection. The usual methods of procedure, such as threaded and threadless fittings, and the use of locknuts and bushings, is covered under Sections 250-72 and 250-75. I am unable to locate any code rule which specifically prohibits the welding of fittings to boxes. A locknut welded to a box would minimize a loose connection due to vibration. The fact remains, however, that welding would destroy the protective coatings previously discussed. Since the code does not specifically cover welding, it appears that the inspector could interpret the general provisions of Section 300-10 to include this method of procedure whenever unusual conditions dictated such use.—B.A.McD.—2/61/2

Garden Lighting

Q. *What type of lighting fixtures and method of wiring is required for decorative lighting in flower beds? Lighting fixtures will be buried in the earth of the flower bed with top of fixtures flush with ground level. The flower beds are exposed to the weather.—E.K.*

A. The location mentioned above would be classed as a wet location. Therefore, Section 410-4(a) would apply to the type fixture used, and reads as follows: "Fixtures installed in damp or wet locations shall be approved for such locations and shall be so constructed or installed that water cannot enter or accumulate in wireways, lampholders or other electrical parts." Also, the following information is contained in the Tenth Edition, or latest, of the National Electrical Code Handbook by Abbott and Stetka, which is a part of the explanation following 410-4. This explanation concerns the fixtures in damp or wet locations. "An enclosed and gasketed fixture would fulfill the requirement that water shall be prevented from entering the fixture, though under some conditions water vapor might enter and a small amount of water might accumulate in the bottom of the globe." The wiring method shall correspond to the fixture requirement, and I would suggest rigid metal conduit for the raceway with conductors approved for wet locations. My reason for suggesting rigid conduit is in order that one would have a substantial method of anchoring the fixtures in the earth and for protection by the raceway for conductors from the gardener's tools used in working the flower beds—R.E.W.—2/61/3

Feeder Calculations

Q. *According to the provisions of Section 220-2, the unit lighting loads expressed in watts per sq ft must be increased by 25% when such loads continue for long periods of time. As a result, the feeder capacity will be increased in proportion. When the feeder serves both lighting and motors, as covered by Section 430-25, is it necessary to apply another 25% increase to take care of the motor load?"—R. L.*

A. It appears to me that we have two distinct rules which must be satisfied. One concerns a lighting load used for a long period of time, and the other concerns the characteristics of a motor load which at times may exceed its nameplate current rating, and may be protected by overcurrent devices rated at 125% of the motor nameplate rating. For the convenience of our readers, the provisions of Section 220-2 are quoted as follows:

"Where in normal operation the maximum load of a branch circuit will continue for long periods of time, such as store lighting and similar loads, the minimum unit loads specified in this Section shall be increased by 25%."

The 1956 version of this rule included the explanatory phrase, which read as follows: "In order that the wiring system may have sufficient branch circuit and feeder capacity to insure safe operation." This phrase was deleted in the 1959 edition of the code with the following comment:

"Not only is the statement inaccurate but it is not required in the code to explain the reason for requirements."

The occasion for the 1959 version of the rule is explained by Panel No. 2 as follows:

"The reason for the 25% factor is to protect the equipment to which the wiring is connected by giving it a 25% reduction in load."

The foregoing comment may be verified by reference to the proposed amendments of the 1956 NEC.

In view of the foregoing, it appears that a feeder, which serves a combination lighting and motor

Hugh Kirkland (Right), President, Kirkland Masonry, Inc., Miami, Fla., talking to Dick Rogers, his Dodge Representative.

"Last year, we got over $4,400 in new business for every dollar we invested in Dodge Reports"

"Dodge Reports actually doubled our business in 1959, the first year we used them," says Mr. Kirkland. "And we doubled that increase last year!" Mr. Kirkland concentrates in the competitive south and central Florida markets. When he decided that his firm could realize its maximum growth potential only by actively competing for more commercial, industrial and residential contracts, he began using Dodge Reports. "We knew," he says, "that unless we kept ahead of the latest developments in these markets, contracts would be awarded to our competitors before we even heard of the jobs." In the two years since that decision, his firm has captured over $3-million in new business – most of it commercial and industrial contracts that he couldn't even have bid on without Dodge Reports. Today, he is one of south Florida's leading masonry contractors.

Daily Dodge Reports tell Mr. Kirkland all he needs to know: type of project and cost, names of owners, architects and engineers, names of general contractors bidding, results of the bidding, and award of the general contract. "We have to be there with a bid *before* the general contract is awarded because the GC has to incorporate our bid in his," Mr. Kirkland says. "Dodge Reports give us the facts we need *in time* to figure the job and get it!"

Dodge Reports can get new business for you, too – at surprisingly low cost. Send the coupon for further information. Or, consult your telephone directory for the Dodge office (in over 80 principal cities) nearest you.

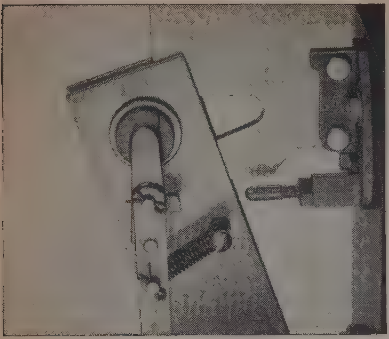
F. W. DODGE
CORPORATION
DODGE
reports
119 W. 40th St., New York 18, N. Y.

F. W. DODGE CORPORATION
Construction News & Statistics Div., Dept. ECM-21
119 West 40th Street, New York 18, N. Y.

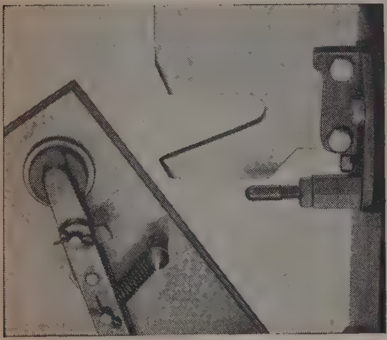
Please ☐ send me your brochure "How Subcontractors Get More Work in New Construction."
☐ send full case history on Mr. Kirkland.
☐ have a Dodge Representative call.

Name ______________________
Company ______________ Title ________
Address ______________________
City ____________ Zone ________ State ______

OPENS EASILY



EVEN AFTER 10 YEARS



OF CLOSED OPERATION
yet this
service-entrance switch
requires no maintenance

This is the ultimate test of a service-entrance device. Will it open in an emergency—after remaining closed for years, with little, if any, maintenance? The fused Pringle switch does. Against any overload. Its contacts are bolted together by a simple, rugged toggle mechanism that turns a bolt through the blades, pulling them together, tight against the fixed contacts. There is nothing to loosen, stiffen or fatigue. Nothing that needs any maintenance. Bolted contact pressure is constant, independent of springs, unaffected by heat. It permits this switch (1200 to 5000 amps) to carry full load continuously, with a heat rise at the contact areas considerably less than the accepted 30°C.

The performance of the Pringle switch is a matter of record. Proven in laboratory tests. Confirmed by the fact that many of them have been in service for more than 25 years. The entire story—including models, ratings and load-break test data — is in the Service Entrance Catalog. A copy is yours upon request.

PRINGLE
ELECTRICAL MANUFACTURING CO.
1906 North Sixth Street
Philadelphia 22, Penna.

SA2273

Store building 50ft x 60ft
Load: General lighting and 1-5-hp, 230-volt motor
System: 115/230 volt, single phase, 3 wire

General lighting load:
60 x 50 = 3000 sq ft
3000 x 3 watts per sq ft x 1.25* = 11,250 watts
11,250 ÷ 230 = 49 amps.

5-hp, 230-volt motor = 28 amps
(Table 430-148)
Size of feeder:
28 x 1.25* = 35 + 49 = 84 amps
(Section 430-25)
*Both factors applied.

load, must satisfy the provisions of *both* Sections 220-2 and 430-25 when the lighting load continues for long periods of time.

The example above covers the rules as I understand them—B.A.-McD.—2/61/4

Non-Metallic Conduit

Q. *Is it contemplated that requirements for non-metallic conduit will be included in Chapter 3?—A.M.*

A. This has been proposed on numerous occasions. It would seem that such an Article should be included in Chapter 3.

In the Underwriters' Laboratories' listing "Conduit—Non-metallic" these conduits are shown as listed for use only when installed underground. Some of these are listed for direct burial and others require complete encasement in concrete.

It should be noted that one type, that manufactured by the Kraloy Plastic Pipe Co., Inc., is also recommended by the manufacturer as a non-metallic rigid raceway system for interior wiring. The UL listing does not cover this application and the manufacturer specifically calls attention to this in his literature. However, complete wiring may be accomplished since fittings such as Type C, T, LL, LB and LR are available in this same material.—B.Z.S.—2/61/5

Wiring for a Submersible Pump

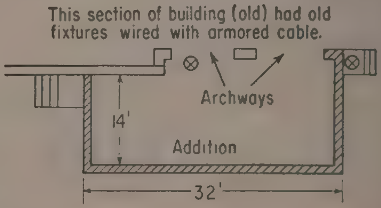
Q. *What type wiring should be used for a branch circuit to a submersible water well pump, and what method of splicing should be used in making connections from the submersed pump motor leads which are usually approximately 18 in. long to the branch-circuit conductors running from above ground level to the pump motor located in the earth?—G.H.*

A. The wire or cable used should be approved for wet locations and the method of splicing should of necessity be waterproof. In installations that I am acquainted with, the manufacturer of the submersible pump furnishes a splicing kit with sleeves, etc., to make the necessary connections between the branch-circuit conductors and the motor leads. When the kit is used according to the directions, one will have substantial waterproof joints that are trouble free. The pump manufacturer also furnishes a cable approved for wet locations for the branch circuit. The usual procedure for anchoring or fastening the cable in place is by using a plastic tape, taping the cable at approximately 5-ft intervals on the drop pipe that extends into the well that the motor is fastened to. This is one of the many installations that electrical inspectors, as well as the electrical or wiring contractor, are required to use their best judgment in making a trouble-free installation; and apparently in our state such installations have been trouble free with reference to the electrical connections, conductors and other items.—R.E.W.—2/61/6

Armored Cable—Church Occupancy

Q. *Recently a 32-ft by 14-ft addition was built on to our church. We wired it with armored cable. When we called for inspection, the inspector said we had to take out all the armored cable and install a metal raceway or Wiremold because of a new code rule. The new addition has a solid brick wall about 12-ft long and two archways, as shown on the diagram. The section of the original building had existing fixtures wired with armored cable.*

I removed all the new armored cable and installed EMT, but left in


This section of building (old) had old fixtures wired with armored cable.
Archways
14'
Addition
32'

GENERAL ELECTRIC ANNOUNCES VULKENE*

The first really new general-purpose cable insulation in 15 years

WITH THESE ADVANTAGES

1. Combined insulation and jacket
   No jackets on singles up to 5 kv
2. Space saving—up to 30% smaller diameter
3. Outstanding heat stability
   Better than rubber or plastics
4. Outstanding chemical resistance
   Better than rubber or plastics
5. Electrical properties approaching polyethylene
   Better than rubber or polyvinyl chloride

IN A NEW

General Electric Industrial Control Cable

This new control cable is available in sizes No. 14, 12, and 10 Awg (7 strand), 2 through 12 conductors, 600 and 1000 volts.

WITH THESE FEATURES

1. Thermosetting insulation—90 C conductor temperature
2. Emergency overload—130 C conductor temperature
3. Electrical characteristics better than rubber or polyvinyl chloride
   Dielectric constant—3.0 typical, 3.5 maximum
4. Moisture resistance better than rubber or polyvinyl chloride
   4 mg/sq in. typical, 5 mg/sq in. maximum (IPCEA—GM)
5. Best over-all chemical resistance
6. Smaller diameter than rubber or polyvinyl chloride—20 to 30% smaller diameter than rubber
7. Most sizes in stock
8. A lower price than rubber

** Registered Trade mark General Electric Company*

For more information, simply fill in and mail the coupon.

General Electric Company
Wire and Cable Department
Section W-302, Bridgeport 2, Connecticut

Please send me more information on General Electric Vulkene industrial control cable.

Name____________________

Title____________________

Company____________________

Address____________________

City__________Zone_____State__________

Progress Is Our Most Important Product

GENERAL ELECTRIC

The Best Way To Install Boxes & Fixtures In Dropped Ceiling Work . . .

Arrow Conduit

CHANNEL SUPPORT

MORE ECONOMICAL!

MORE EFFICIENT!

No more makeshift arrangements! These features are "selling" contractors, everywhere!

- Many slots allow fixture stud to be attached anywhere on support
- Special design in this support assures maximum strength and rigidity for supporting fixtures
- Two sizes: 1" wide by ½" deep 1½" wide by ¾" deep
- Made in 10 ft lengths. Can be cut in multiples of 6".
- 14 gauge galvanized steel.

Samples and specification sheets on request.

OUTLET BOXES • GANG BOXES • COVERS • BOX SUPPORTS

ARROW CONDUIT & FITTINGS CORP.

108–20 180th Street, Jamaica 33, N. Y.

ARROW CONDUIT & FITTINGS CORP

Sales Representatives & *Warehouse Stocks *ATLANTA GA • BALTIMORE, MD • *BIRMINGHAM ALA • *CHICAGO, ILL • *CINCINNATI 37, OHIO • DALLAS TEXAS • *DETROIT 2, MICH • GREENSBORO N C • *KANSAS CITY, MO • *LOS ANGELES CALIF • *MIAMI FLORIDA • *NEW ORLEANS, LA • NEW YORK CITY, N Y • NEWTON CENTRE, MASS • *PHILA, PA • RICHMOND VA • ROCHESTER, N Y • *SEATTLE, WASH

the existing fixtures, supplied by the original armored cable, moving the switch location no more than 3-ft. The inspector said that I had violated Section 520-4 of the NEC, which reads:

"The wiring method shall be metal raceway or Type MI cable except as follows:

"Exception No. 2. Where the auditorium has a capacity of less than 200 persons, armored cable as provided in Article 334 may be used.

The scope of Article 520 is quoted as follows;

"520-1. Scope. The requirements of this Article shall apply to all buildings, or part of a building, designed, intended, or used for dramatic, operatic, motion-picture or other shows, and night clubs, dance halls, armories, sporting arenas, bowling alleys, public auditoriums, television studios and like buildings used for public assembly."

It is my belief that this addition comes under Section 520-1, as being a part of a building; and also under Exception No. 2 of Section 520-1 as having a capacity under 200 people itself, and therefore we should not have been made to take out the armored cable. I would appreciate your opinion on this—J.W.C.

A. You are correct in assuming that a church comes within the scope of Section 520-1. This question was settled by Official Interpretation No. 431, issued in 1959. It reads as follows:

"Question—Is it the intent of Section 5201 of the 1953 edition of the NEC that churches be included by the phrase—and other buildings used for public assembly?

"Answer—Yes"

Since the total area of the addition is only 448 sq ft, it is quite obvious that it does not have a capacity for 200 people. It is significant to observe the fine print note following Section 520-4, Exception No. 2. It is quoted as follows;

"For recommendations for determination of population capacity, refer to NFPA Building Exits Code (No. 101)."

According to this Code the population capacity of a room, where chairs are not secured to the floor, is based on one person for each 15 sq ft of floor area. As a result, the population capacity of the room in question is considerably less than 200 persons (448 ÷ 15 =30 persons).

While the room in question does not have a capacity for 200 persons it appears to me that it is not cutoff from other areas of the church, such as the church auditorium which undoubtedly has a capacity of more than 200 people. As a result, a fire originating in the new section would promote a serious hazard to the entire building. The resulting smoke alone could constitute a serious hazard. The provisions of Paragraph 2181 of NFPA No. 101 covers the situation as follows:

"2181. Places of assembly in buildings of other occupancy, such as ballrooms in hotels, restaurants in stores, assembly rooms in schools shall be so located, separated or protected as to avoid any undue danger to the occupants of the place of assembly from a fire originating in the other occupancy, or smoke therefrom.

Depending upon the character of construction and the hazard of the occupancy, this will require some physical separation by walls of appropriate fire resistance, protection of the other occupancy by automatic sprinklers, or other appropriate measures. Where the building is of fire-resistive construction, and the hazard of the other occupancy is low or moderate as in a school or hotel, no separation may be necessary."

In view of the foregoing, I am inclined to believe that the inspector was correct when he criticized the use of armored cable in the new addition. Regardless of this opinion, you have the satisfaction of knowing that there is no question with respect to the wiring method used. In the event of a fire, you and the property owners have absolved yourself of any guilt which would result from a troubled conscience. The inspector, who has the responsibility for interpreting code rules, would share the same feeling. After all, he is the one who might have to face a judge with the task of defending himself from any accusation of negligence. The additional investment in EMT certainly is warranted when these and other factors are considered. B.A.McD. —2/61/7

Computing Size of Service

Q. *In calculating size of service for a building using electric heat, what demand factor can be used for the heating part of the load where unit heaters are used that are not thermostatically controlled? —J.S.F.*

EXECUTONE EXTRAS

help you bid profitably on intercom and sound systems

In today's big market for sound and intercom, Executone equipment is known for *highest standards of performance*. Hundreds of contractors are *also* discovering that they can put in a reputation-building Executone system at *lowest installed cost*. Here's why:

- **MINIMUM FIELD ASSEMBLY** Executone equipment is engineered for minimum assembly time on the job to meet contractors' field-installation problems. Most equipment comes completely assembled . . . components have plug-in terminal blocks. Hook-up time is cut to a bare minimum.

- **COMPLETE CO-ORDINATED SYSTEMS** You get everything you need from one responsible source . . . proven equipment, wire specifically designed and color-coded for the system. One-source responsibility cuts paper-work, delays, confusion.

EXPERT PRE-PLANNING Without obligation, your local Executone distributor will provide you with the services of an experienced systems engineer . . . to help in analyzing a project's needs . . . planning the required system with greatest installation economy . . . preparing bids and estimates.

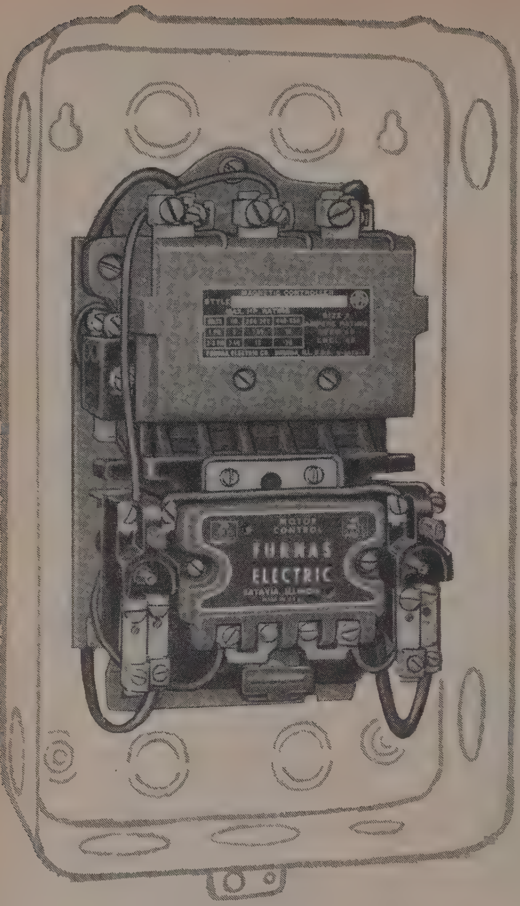
- **INSTALLATION ASSISTANCE** An expert Executone field engineer is available to supervise every job. He helps you get in and out fast . . . assures you of proper hook-up, adjustment of the system and check out.

- **NO SERVICE CALL-BACKS** When you turn over the completed installation, Executone takes immediate responsibility for the proper operation of the system. The factory and the local Executone distributor give your customer unmatched guarantees and service on the premises.

Start building profits the Executone way. Check the coupon below for information on Executone sound and communication equipment for selected building types. We'll also send you a convenient Conduit Selection Chart to help you cut costs in layout and installation.

Executone
COMMUNICATION and SOUND SYSTEMS

Executone. Inc.
Dept. Y-7, 415 Lexington Avenue, New York 17, N. Y.
Send me your Conduit, Wire and Cable Chart. Also:
information on Executone equipment for
☐ schools ☐ hospitals ☐ offices ☐ plants
☐ retail stores ☐ homes ☐ ____________
Name____________________Title__________
Company____________________
Address____________________
City______________Zone______State______
In Canada: 331 Bartlett Avenue, Toronto



NEW SIZES 2 and 2½ FURNAS MAGNETIC STARTERS

Take advantage of the new design of Furnas Size 2 and Exclusive Size 2½ Starters. Rated through 30 hp, 440 volts, the Size 2½ fills many applications normally requiring a much larger Size 3 Starter. Their flexibility means simplified field addition of push buttons, auxiliary contacts or third overload relays. All components are front removable for easy servicing or inspection. Dual voltage coils, silver-cadmium oxide contacts, pressure type wiring terminals and trip-free thermal overload relays assure you of Furnas superior quality, longer life and unmatched economy.

Write today for Bulletin 14-B2— 1067 McKee St., Batavia, Illinois.

A91

FURNAS
ELECTRIC COMPANY
BATAVIA • ILLINOIS
SALES REPRESENTATIVES IN ALL PRINCIPAL CITIES

A. In such an installation the computed load will be the total connected load on all the branch circuits. The exception to the rule is Exception No. 1 of Section 220-4(e), which reads:

"Where reduced loading of the conductors results from units operating on duty-cycle, intermittently, or from all units not operating at one time, the authority enforcing this code may grant permission for feeder conductors to be of a capacity less than 100%, provided the conductors are of sufficient capacity for the load so determined."

Therefore, the exception does not apply. Section 220-4(e) concerns feeders. However, in figuring size of services, Section 230-71(a) applies as it states that the load to be carried is determined in accordance with Article 220. Therefore, Section 220-4(e) applies to services as well as feeders.—R.E.W.—2/61/8

Staples to Fasten Cables

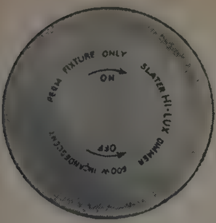
Q. *Is it the intent of Section 422-37(b) to prohibit the use of staples in fastening floor cable to pre-molded membrane used between the fill or earth and the poured concrete floor?—F.H.*

A. No. Section 422-37(b) reads as follows:

"Cables shall be secured in place by non-metallic frames or spreaders while the concrete or other finish is applied."

As chairman of the sub-committee on electric heat, and as a member of the committee, I know it was not the intent of either committee to prohibit the use of staples as above mentioned in your question. The fact is such an installation was not considered. The wording as is recorded was to prohibit the use of metal frames or spreaders being used that would connect or reach several runs of cable by the continuous run of metal frames or spreaders. The method you mention has been tested by Underwriters' Laboratories and is acceptable. There is no difference in the use of staples to fasten the cable to a premolded membrane or plastic material and the use of staples to fasten ceiling cable to gypsum board overhead. The method of using staples fastening cable to gypsum board ceiling is permitted by Section 422-35(e) and is accepted practice in the field.—R.E.W.—2/61/9

SLATER PROVES AGAIN... QUALITY COSTS NO MORE!



NEW "HI-LUX" ROTARY DIMMER HAILED AS MAJOR ADVANCE!

SLATER completely explodes the myth of buying dimming controls by the pound. Compare the revolutionary HI-LUX Dimmer with any other incandescent light control. Use any yardstick. HI-LUX is small (a neat 1½" deep, 1½" high and 1" wide). Fits standard switch boxes with room to spare. Uses standard wiring (only 2 connections). Employs semi-conductors. Needs no transformers or rheostats. That's HI-LUX... compact, dependable, superbly engineered.

HI-LUX is rated at 500 Watts and may be installed in 3 or 4-way circuits for all incandescent applications. For additional information and prices call, wire or write today.

- **Low in cost**
- **Compact in size**
- **Fits all standard switch boxes**
- **Installs in minutes**

CALL, WIRE or WRITE ...*TODAY*

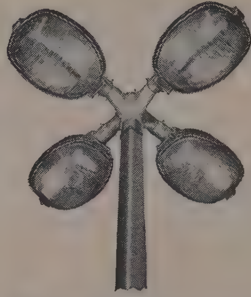
Slater

ELECTRIC & MFG. CO., INC.
GLEN COVE, L. I., NEW YORK
In Canada:
E. & H. Sales Reg'd. • 9735 Jeanne Mance St., Montreal 12, P.Q.

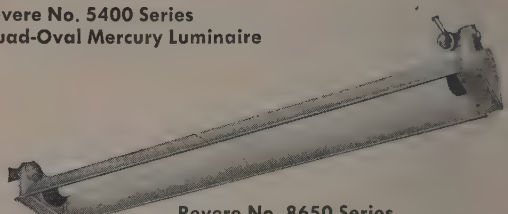
Slater Electric & Mfg. Co., Inc.
Dept. CB
Glen Cove, L. I., N.Y.

NAME..
COMPANY..
ADDRESS...
CITY..............................ZONE........STATE....................

Revere No. 4200 Series Floodlight



Revere No. 5400 Series Quad-Oval Mercury Luminaire



Revere No. 8650 Series "Fluoresign" Luminaire

Widest line of fixtures lets you light every outdoor area the one best way for each job

You can plan each industrial, commercial, or transportation area outdoor lighting application the one *best* way for the job at hand and get *all* the fixtures, poles and accessories required from one source — your Revere wholesaler.

Ordering all components from your Revere wholesaler takes the "headaches" out of ordering, receiving and installing. Revere has exactly the fixtures you want, with matched components engineered for easy installation, peak lighting efficiency and best appearance.

Revere offers the widest line of fixtures in the industry for all types of outdoor lighting applications. You can select hinged or rigid poles . . . mercury, incandescent or fluorescent luminaires . . . floodlights, fixtures and fittings — whatever is called for to do the job the one best way.

Let your Revere wholesaler show you how Revere equipment eliminates the problems in outfitting your installations. Write to us for Revere's complete catalog of outdoor lighting equipment.

Revere®
ELECTRIC MFG. CO.

OUTDOOR LIGHTING

Revere Electric Mfg. Co. • 7420 Lehigh Avenue • Chicago 48, Illinois (In suburban Niles)
Long Distance Phone: NIles 7-6060 • Chicago Phone: SPring 4-1200 • Telegrams: WUX Niles
In Canada: Curtis Lighting, Ltd., Leaside, Toronto, Ontario

In the News

Plant Maintenance Conference Held in Chicago

Key problems in application and care of modern electrical facilities are discussed.

The 12th Plant Maintenance and Engineering Conference and Trade Show held in Chicago January 23-26 attracted a combined attendance of nearly 20,000 according to preliminary estimates. Over 375 companies exhibited in the show.

Among subjects of discussion in the conference program was the decline in profit margins of manufacturing companies despite increased sales and the role of maintenance in cutting indirect costs of production. Automation and other modern industrial practices while reducing direct production costs are increasing the responsibility and costs of the maintenance function in industry.

L. C. Morrow, general chairman of the conference, sounded the keynote in citing the "shocking" inefficiency of manufacturers in maintaining their factories and machinery. He directed attention to estimates which "in the field of maintenance, show that we achieve only 40% of worker efficiency—largely due to management shortcomings."

Exploring the plant engineer's responsibility for building design and construction, John M. Connelly, plant engineer of Royal McBee Corp., Springfield, Mo., pointed out that the IES recommended practice is the accepted standard and that the trend today is to use these standards as absolute minimum requirements only. He also emphasized the use of a maintenance factor in lighting calculation. In noting the changes in factory architecture he said, "Night time security is promoted by shadowless lighting. Parking areas and approaches are well illuminated. Building exteriors are swathed in light—with results not only in appearance improvement, but in dollar savings."

Roy E. Snider, superintendent of maintenance and construction, A. C. Spark Plug Division, General Motors Corp., Flint, Mich., reported on his plant practice in the upkeep of electronic and other control instruments. In a plant employing 12,500 people, 13 men perform electronic maintenance which includes calibration of test equipment, time clocks and heat control instruments. In addition five electronc maintenance men do nothing but electronic maintenance in the defense area. Forty three additional electricians do a combination of electrical and electronic maintenance, 95% of the electrical men came up through the plant's apprenticeship program.

Discussing keeping ahead of power system problems, Leonard R. Hostetter, process and production engineer, Buick-Oldsmobile-Pontiac Assembly Division, General Motors Corp., Linden, N. J., laid down seven fundamental principles—safety of operation; simplicity of operation; reliability of service; economics of installation and operation; flexibility of operation; expandability for future needs; and maintenance programs.

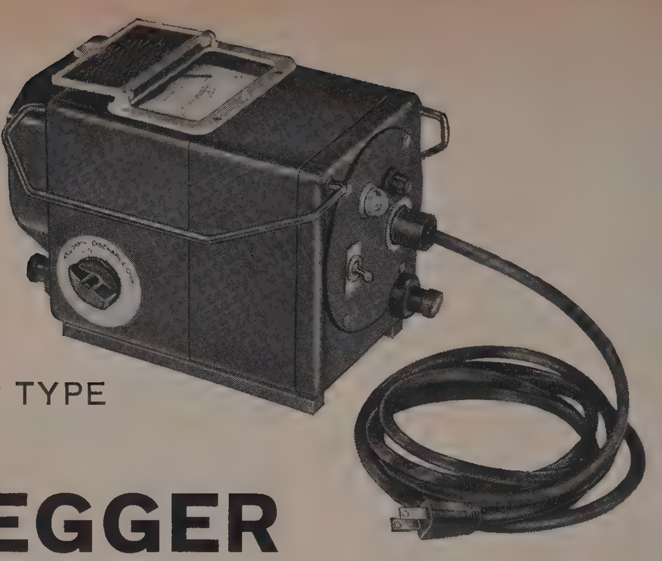
In a program devoted to the pro's and con's of outside contracting R. B. Beattie, superintendent of engineering, maintenance and construction, Delaware Refinery Tidewater Oil Co., Delaware City, Del., strongly supported the case for contract maintenance. He cited the large fluctuation in manpower—between 159 and 924 men. In a typical instance, the contractor's manpower rose from a pre-shutdown level of 181 men to 480 men at the end of the first week, to 900 men seven days later and 924 men the following week.

Opposing outside contracting, A. P. Olbrich, chief maintenance consultant, Refining Department, Phillips Petroleum Co., Bartlesville, Okla., cited the experience of his plant where 800 employees are hourly maintenance personnel. Contract work is estimated at only 5% to 7% of the total work. The contractor's hourly rate, he noted, was on a comprehensive basis higher than that of plant personnel. To give favorable consideration to contracting all maintenance work "we should have to conclude that a contractor can do a more effective job in manpower utilization than we can. All of our experiences to date have been to the contrary."

John Frommer Elected President of New York Electrical League

John W. Frommer, president of L. K. Comstock & Co., Inc., was elected president of the Electrical League of New York, Inc. at the annual meeting held January 17, succeeding Carrol L. O'Shea. Also elected were C. Ashmead Biddulph, Thomas & Betts Co., as vice president; William W. Stecker, Consolidated Edison Co. of New York, Inc., as secretary, and Carl J. Schlaick, of General Electric Supply Co., as treasurer.

The division officers elected were: *Contractors*—Milton R. Minto, MacNutt Electric Co., as chairman; Ronald H. Webster, T. Frederick Jackson, Inc., as vice chairman; and Felix Hirsch, Hirsch Electric Co., Inc., as secretary. *Distributors*—H. M. Brundage, General Electric Supply Co., as chairman; Max Kamin, Shell Electric Supply Co., vice chairman; and Joseph Lorenz, Central Queens Electric Supply Co., as secretary. *Manufacturers*—William S. Catherwood III, Murray Manufacturing Co., as chairman; S. M. Shor, Empire Switchboard Co., as vice chairman; and Harvey E. Hurst, Phelps Dodge Copper Products Co., as secretary. *Manufacturers Representatives*—E. N. Kearton, Kearton & Nagle Co., as chairman; H. O. Gerdts, H. O. Gerdts Co., as vice chairman; and Perry Meyer, Jae & Meyer Co., as secretary. *Utilities*—R. F. Darmody, Consolidated Edison Co. of New York, Inc., as chairman; A. J. Hartmann, Consolidated Edison Co.



MEG® TYPE
OF
MEGGER
(Reg. U. S. Patent Office)
Rectifier-Operated
INSULATION TESTERS

For repetitive insulation resistance tests on a production basis . . . and for time-resistance tests . . . nothing equals the Meg Type Rectifier-Operated Insulation Tester for convenience and reliability. The plug-in rectifier source of power permits the instrument to be used without hand cranking. A constant-voltage feature reduces pointer fluctuations which may occur when testing equipment having appreciable capacitance, such as larger generators and long cables. Standard units are available for 500 or 1000 volts d-c test potential and for ranges up to 2000 megohms.

Other Megger Insulation Testers include hand-crank models and Dual-Operated sets. The latter are versatile instruments with rectifier for repetitive or time-testing that can be disconnected for hand-crank operation in the field.

Write for BULLETIN 21-46-ECM

BIDDLE IMPULSE CABLE FAULT LOCATING EQUIPMENT

. . . for locating cable faults by impulse tracer method . . . for D-C proof testing. Applicable to aerial and buried cable as well as lead-covered cable in ducts. Transmitter can be connected to 115 V, 60 cps supply.

MODEL 3-2—Output voltage up to 25 kv. Discharge capacitance 1.65 muf. For use on cable up to 15 kv rating.
MODEL 4-2—Output voltage up to 15 kv. Discharge capacitance 2 muf. For use on cable up to 5 kv rating.
MODEL 5-2—Output voltage up to 5 kv. Discharge capacitance 16 muf. For use on cable up to 1 kv rating.

Write for
BULLETIN 65-ECM

B920

JAMES G. BIDDLE CO.
• ELECTRICAL TESTING INSTRUMENTS
• SPEED MEASURING INSTRUMENTS
• LABORATORY & SCIENTIFIC EQUIPMENT
1316 ARCH STREET
PHILADELPHIA 7, PA.

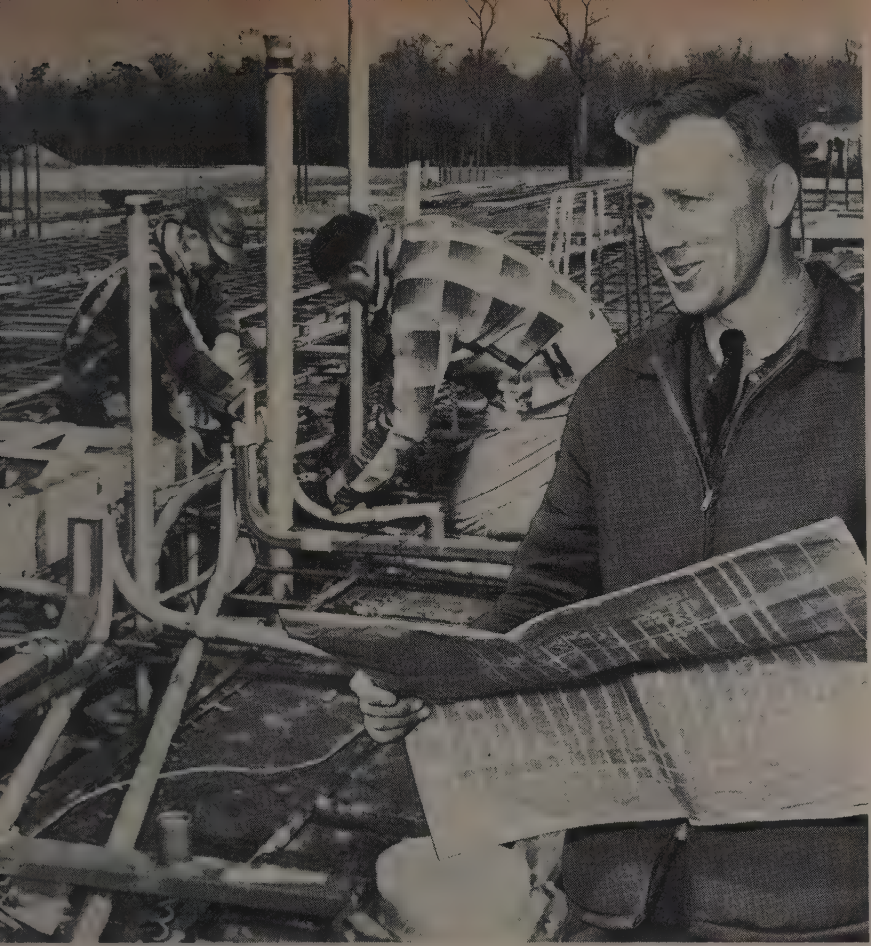
of New York, Inc., as vice chairman; and A. L. Herbert, Long Island Lighting Co., as secretary. *Associates*—R. A. Hubley, McGraw-Hill Publishing Co., Inc., as chairman; J. Andrew Painter, First National City Bank of N. Y., as vice chairman; and L. D. Kennedy, Greater City Electrical Contractors Association, as secretary.

George C. Monroe Named IAEI President

George C. Monroe, superintendent, Springfield District, Missouri Inspection Bureau, Springfield, Mo., was named president of the International Association of Electrical Inspectors. During the past year he was first vice president of the Association.

A member of the Missouri-Kansas Chapter, IAEI, since 1929, Mr. Monroe has been prominently engaged in Association activities. He served for ten years as Western Section Chapter Affairs Committee chairman; is past-chairman of Article 422 Code Committee; is past-president, Western Section, IAEI; has been a member of several IAEI code panels. He was elected to the IAEI Executive Council in 1955 and has risen steadily through all the executive ranks to the presidency.

Mr. Monroe's entire career has been in the electrical field. His early experience was gained in switchboard manufacturing and assembly, power plant operation, industrial electrical installation and maintenance. He has been with the Missouri Inspection Bureau since 1926, starting as an electrical in-



Exterior of Prudential's new building, one of the show places of southern New Jersey.

Architect: Frank Grad & Sons, Newark, N.J.
General Contractor: Massett Building Company, Atlantic City, N.J.
Electrical Contractor: William E. Snell Electrical Construction Company, Vineland, N.J.
SPANG Distributor: Serv-U-Electric Company, Penns Grove, N.J.

◀ Superintendent George Hess reviews wiring blue print at job site. Spang Conduit provides top-quality wiring protection in new Prudential Life Building. These two-story facilities provide 200,000 sq. ft. of space, house 1,000 employees, cost $3,000,000.

Q. "WHAT DO YOU THINK OF SPANG CONDUIT QUALITY, MR. HESS?"

A. "SPANG is uniform in diameter and straightness, and the finish is very good!"

SPANG® CONDUIT

That's George Hess speaking. He was superintendent for William E. Snell Electrical Construction Company, Vineland, N.J. We interviewed him and Howard Franz, Snell field representative, at the new Prudential Life Insurance Company of America Building at Linwood, N.J., where they were making a SPANG Steel Conduit installation.

Mr. Franz said, "SPANG Conduit bends, threads and cuts well. The galvanized finish doesn't chip, crack or blister during bending. We've had no problems of white rust or other corrosion, even in this salt-air region.

"SPANG has a smooth interior finish—no burrs, snags or imperfections to cause wire-pulling problems. We know this installation will last the life of the building."

That's SPANG quality at work!

. . . and it will work for you, too—in SPANG Steel HD Galvanized, SPANG Steel Black Enameled, SPANGLEAM EMT and SPANG Rigid Aluminum Conduit. Try them and see! For quality service on all your electrical requirements, call your nearby SPANG Distributor.

SPANG Conduit is one of the many fine products produced by *National Supply Division, Armco Steel Corporation, Two Gateway Center, Pittsburgh 22, Pennsylvania.*

ARMCO National Supply Division

American Industry has chosen...

TY-RAP™ cable ties and straps

for Tying—replaces string on wire harnesses.

for Clamping—only one size needed.

for Identification—permanent, convenient and attractive, replaces tags.

because...

the Ty-Rap method is, simpler, faster, more economical. A Modern method designed to do a complete job.

Write for our Bulletin TR3 and learn how this T&B engineered for "Lowest Installed Cost" method can save you time and money.

SOLD COAST TO COAST EXCLUSIVELY BY YOUR T&B DISTRIBUTOR

T&B ENGINEERED

THE THOMAS & BETTS CO.
INCORPORATED
ELIZABETH, NEW JERSEY
IN CANADA, THOMAS & BETTS, LTD., MONTREAL

spector in the engineering department and advancing through a variety of assignments to District Engineer and his present position with the Bureau. In the interim he gained recognition as a fire protection engineer and became a charter member of the Society of Fire Protection Engineers.

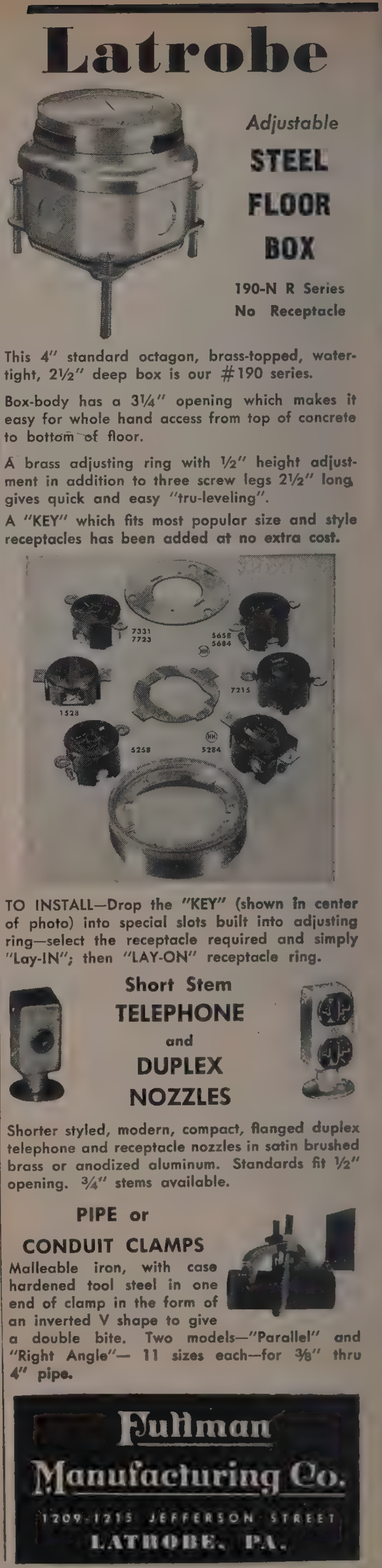
World Lighting Forum To Be Held

A series of nine power-packed symposiums, on lighting subjects vital to all facets of the lighting industry, will be held next month as a highlight feature of the 3rd National Lighting Exposition, March 5-8, in the Coliseum, New York City. Participating will be 32 well known national and international lighting authorities.

Subjects to be covered in the three-day meeting, a World Lighting Forum, include: Integration of Lighting, Heating and Air-Conditioning; Success of the New (IES) Recommended Lighting Levels (for office, industrial and institutional); New Light Sources and Their Application; Creation of Comfortable Visual Environment (Quality and Quantity); Importance of Adequate Street Lighting; Outdoor and Recreational Lighting; Residential Lighting; Esthetics of Lighting Pertaining to Entertainment (Theatre, High School Auditorium, Art Objects, etc.); and World Lighting and its Effects.

Speakers will include such au-

PROBING the relationship between good wiring systems and reduced maintenance are (L to R) E. J. Fuller, chief electrical inspector, Ellis Kansas, and David Hendricks, electrical maintenance chief at Missouri Baptist Hospital, Overland, Ohio, during Western Section, IAEI conference in Kansas City.


Latrobe

Adjustable STEEL FLOOR BOX
190-N R Series
No Receptacle

This 4" standard octagon, brass-topped, watertight, 2½" deep box is our #190 series.

Box-body has a 3¼" opening which makes it easy for whole hand access from top of concrete to bottom of floor.

A brass adjusting ring with ½" height adjustment in addition to three screw legs 2½" long gives quick and easy "tru-leveling".

A "KEY" which fits most popular size and style receptacles has been added at no extra cost.

TO INSTALL—Drop the "KEY" (shown in center of photo) into special slots built into adjusting ring—select the receptacle required and simply "Lay-IN"; then "LAY-ON" receptacle ring.

Short Stem TELEPHONE and DUPLEX NOZZLES

Shorter styled, modern, compact, flanged duplex telephone and receptacle nozzles in satin brushed brass or anodized aluminum. Standards fit ½" opening. ¾" stems available.

PIPE or CONDUIT CLAMPS

Malleable iron, with case hardened tool steel in one end of clamp in the form of an inverted V shape to give a double bite. Two models—"Parallel" and "Right Angle"— 11 sizes each—for ⅜" thru 4" pipe.

Pullman Manufacturing Co.
1209-1215 JEFFERSON STREET
LATROBE, PA.

Cuts 2-inch cast iron pipe in less than 2 minutes!

New Skil Model 701 . . . world's only portable electric, metal-cutting hacksaw!

is all-new, Skil Model 701 Recipro Saw
ompanion to the Model 700 all-purpose
cipro Saw—is the only portable power
made specifically for fast cutting of
metal or highly abrasive material, in-
ding stainless, cast iron, metal lath and
lding tile.
t has 2 speeds; 1000 and 1400 strokes
minute for extremely fast cutting of different gauges and densities of metals and with longest blade life. Standard equipment includes steel carrying case and 4 assorted blades.

Ask your Skil distributor to demonstrate either or both Recipro Saw models. Look under "Tools-Electric" in the Yellow Pages. Or write: Skil Corporation, Dept. 130B, 5033 Elston Ave., Chicago 30, Ill.

Improved All-Purpose Model 700! Newest version of world's first 2-speed reciprocating saw. 2600 s.p.m. speed for metal; 3500 s.p.m. speed for wood, compositions, plastic.

SKIL . . . and SKILSAW POWER TOOLS

How
NATIONAL
PRICE
SERVICE
Can Help You!

N-P-S provides a practical way to keep close track of prices. It supplies answers to two important questions—what should material cost—and what is a fair selling price, including a profit. You must know costs of your material at today's level—not yesterday's or last month's. N-P-S gives you this information and keeps it up-to-date. There are many other useful, profit-making functions of National Price Service. Write today for complete details.

HENDERSON-HAZEL CORP. Dept. A-12
13601 EUCLID AVENUE • CLEVELAND 12, OHIO

Gentlemen:
Please send me the complete story of National Price Service, how it will keep me up-to-date with changing material prices, and suggest profitable resale prices—quickly. No obligation.

Name________________
Title________________
Company________________
Address________________
City________Zone____State________

NPS
National Price Service
HENDERSON-HAZEL CORP.

13601 EUCLID AVENUE • CLEVELAND 12, OHIO

COMPARING INSPECTION experiences in their respective municipalities, during Western Section IAEI convention recess, are W. P. Case, Cuyahoga Falls, Ohio; and E. M. Miller, chief electrical inspector, Colorado Springs.

thorities as: Ludovic Gaynard, Paris, France; Willard C. Brown, Abe H. Feder, C. L. Crouch, Thomas Smith Kelly, Rollo G. Williams, George W. Clark, E. A. Linsday, William S. Gill, C. L. Amick, and others. Richard G. Slauer, President of the Illuminating Engineering Society, will deliver the keynote address for the three-day Forum.

Seats will be reserved for each of the nine 1½-hour symposium, at $2.00 per seat. Fee for the series will be $13.50.

The World Lighting Forum is being held in conjunction with the 3rd National Lighting Exposition in which over 200 manufacturers will have on display a broad array of lighting equipment, many designs being shown for the first time. Both the Forum and the Exposition are expected to attract designers, specifiers, distributors, sellers and installers of lighting systems and equipment from all parts of the country.

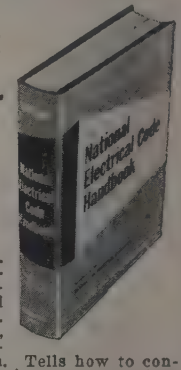
PROPONENT of Code Clarification, electrical inspector Charles Stasek, Cleveland, Ohio, at Western Section, IAEI convention in Kansas City, recommends formation of special committee to study reported superfluity of many code rules.

McGRAW-HILL BOOK NEWS

PRACTICAL ELECTRICAL WIRING

Residential, Farm, and Industrial

Just Published—6th Ed. Presents fundamentals, terminology, basic principles, theory behind practices, and practical wiring instructions, all based on the 1959 National Electrical Code. Includes Code changes. Gives new information on wiring of hermetic motors, recent types of lighting, and installing "MI" cable. **By H. P. Richter, Int. Assn. of Electrical Inspectors. 6th Ed. 574 pp., 461 illus., $7.95.**



NATIONAL ELECTRICAL CODE HANDBOOK

Just Published—10th Ed. Explains National Electrical Code rules, including additions and changes to 1959 Code. Reviews Code rulings, gives concise descriptions of each application. Tells how to conform with all code requirements. **Revised by F. Stetka, Nat. Fire Protection Assn. 10th Ed. 680 pp., 387 illus., 53 tables, $10.00.**

ELECTRICAL CONSTRUCTION COST MANUAL

Shows how to make estimates of electrical construction work, developed through standard assemblies, unit costs of total material and labor costs, and the addition of job factors, overhead, and profit. Helps you develop more realistic, profitable bids. Step-by-step procedures for take-off pricing and summarizing estimates are included, as well as useful graphs, charts, tables, etc. **By R. E. Johnson, Sturgeon Electric Co. 427 pp., 226 illus., $10.00.**

ELECTRICAL ENGINEERING FOR PROFESSIONAL ENGINEERS' EXAMINATIONS

Complete electrical engineering refresher for all candidates for the Professional Engineer's license. Prepares you for the electrical engineering part of the examination, including detailed material expected of engineers testing for the Electrical Engineer group. Each question is followed by the type of answer expected by examining boards. Covers both theory and practical aspects. **By J. D. Constance, Engineering Registration Consultant. 448 pp., 381 illus. $9.50.**

10 DAYS' FREE EXAMINATION

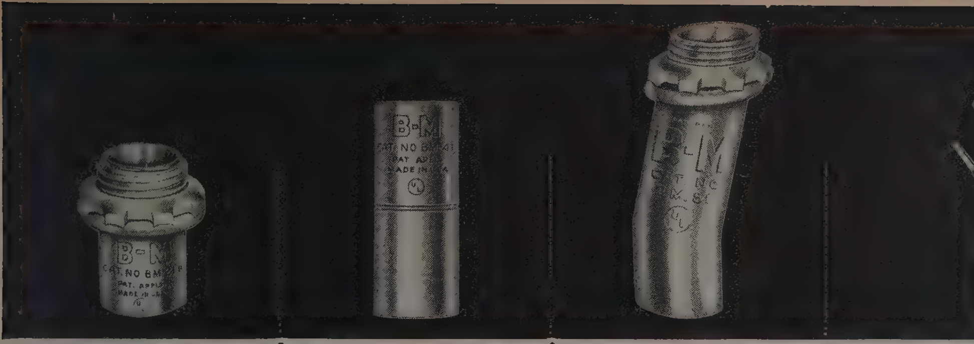
McGraw-Hill Book Co., Dept. EC-2
327 W. 41st St., New York, 36, N. Y.

Send me book(s) checked below for 10 days' examination on approval. In 10 days I will remit for book(s) I keep plus few cents for delivery costs, and return unwanted book(s) postpaid. (We pay delivery costs if you remit with this coupon—same return privilege.)

☐ Richter—Pract. Elect. Wiring, $7.95
☐ Stetka—Nat. Elec. Code H'book, $10.00
☐ Johnson—Elec. Const. Cost Manual, $10.00
☐ Constance—Elect. Engineering for P.E. Exams., $9.50

(PRINT)
Name ....
Address ....
City .... Zone.... State..........
Company ....
Position ....

For price and terms outside U.S.
Write McGraw-Hill Intl., N.Y.C. 36 EC-2



Red Throat
BM-21B
½″ Connector
BM-22B
¾″ Connector
BM-23B
1″ Connector

BM-41
½″ Coupling
BM-42
¾″ Coupling
BM-43
1″ Coupling

BM-51
½″ Offset Connector
BM-52
¾″ Offset Connector

BM Offset Connectors showing how wires are guided over box edge.

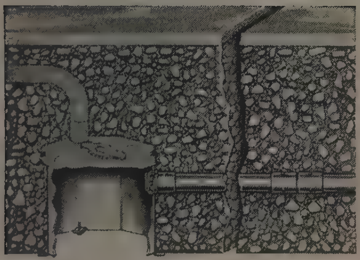
FOR MORE PROFITS

Save time and money with

B-M ORIGINAL INDENTER FITTINGS

Here is the combination that is unbeatable when it comes to easier E.M.T. installation at less cost. New lightweight plier size indenters make setting up thin wall conduit a breeze. B-M fittings are neater too! No unsightly nuts or projecting set screws.

A few more of the plus features of B-M fittings are Concrete tight—Vibration resistant—Extra heavy bright zinc plate, salt spray and acid drip tested for corrosion resistance—Extra heavy positive bonding locknuts—smooth rounded edges or bushed throat type connectors that prevent insulation damage—All steel construction with extra heavy gauge wall thickness.



ALL BRIEGEL FITTINGS ARE U. L. APPROVED AS CONCRETE-TIGHT

When setting E.M.T. in concrete you can make each job easier and more profitable by using Briegel All Steel Indenter Fittings that have UL approval as Concrete-Tight. Contractors everywhere recognize their cost cutting qualities and the fact that they make each wiring job a better job. It is only natural that Briegel Fittings are the most widely used E.M.T. connectors and couplings.

BM PLIER SIZE INDENTERS
BM—No. 607 ½″
BM—No. 608 ¾″
BM—No. 609 1″

LISTED UNDER RE-EXAMINATION SERVICE OF UNDERWRITERS LABORATORIES, INC.

TELESCOPE BM SYSTEM

All B-M indenter type fittings far exceed the requirements of U. L. file card E 10863 and Federal Specifications W-F-406.

BRIEGEL METHOD TOOL CO.
GALVA • ILLINOIS

USED THE MOST FROM COAST TO COAST

Electricians! Maintenance Men!

See COYNE'S New ELECTRICAL-ELECTRONICS REFERENCE SET on 7 Days *FREE TRIAL*

Up-To-Date Reference Library Makes You Worth More On The Job!

Practical, time-saving way for Electricians to keep up with modern electronic equipment and new techniques! Use Coyne's new 4-Volume ELECTRICAL-ELECTRONICS Library at home and for quick reference on the job. Simple explanations, hundreds of working diagrams, trouble-shooting methods from wiring to latest electronic controls. No complicated math; no time wasted. Mail coupon to see set on 7-Day FREE TRIAL.

YOU GET ALL 4 BIG BOOKS

INDUSTRIAL ELECTRONICS. "Gold mine" of information on rectifiers, thyratrons, automatic timers, ignitrons, welding controls, phototubes, Industrial X-Rays, transistors. 495 pages. $3.95

ELECTRICAL TROUBLE-SHOOTING MANUAL. Over 600 diagrams for transformers, motors, controls, generators, converters. Includes tests, measurements, instruments. 626 pages. $6.95

ELECTRICAL WIRING AND ILLUMINATION. Data, techniques, codes for electrical construction; farm equipment; aviation and street lighting; fluorescent, neon, vapor lights; motor-driven appliances. 555 pages. $3.50

ELECTRICIANS HANDBOOK. Reference-data book, includes code rules, specifications, definitions, repair data, test guides. Dozens of charts, tables, rules. 350 pages. $2.95

FREE TRIAL—SEND NO MONEY

Just fill out and mail coupon below. We'll send you all 4 books to use for 7 days FREE. You must agree it's the most valuable reference set you've ever used, or send it back and owe nothing. If you keep the books, send only $3.00 after 7 days and $3.00 per month until $18.50 plus postage is paid. Cash price after 7-day Trial only $16.35 plus postage.

FREE TRIAL COUPON—Mail Now!

Educational Book Publishing Division
COYNE ELECTRICAL SCHOOL, Dept. 21-EM
1455 W. Congress Parkway, Chicago 7, Ill.

☐ Rush 4-book ELECTRICAL-ELECTRONICS Reference Set for 7-Day FREE TRIAL per offer.

To order individual books, check below:

☐ INDUSTRIAL ELECTRONICS ($3.95 plus postage)
☐ ELECTRICAL TROUBLE-SHOOTING MANUAL ($6.95 plus postage)
☐ ELECTRICAL WIRING AND ILLUMINATION ($3.50 plus postage)
☐ ELECTRICIANS HANDBOOK ($2.95 plus postage)

Name ....Age .....

Address ....

City ....Zone ....State ....

☐ $16.35 Cash Price enclosed for 4 books.
☐ Send 4 books C.O.D. for $16.35 plus M.O. fee.

COYNE pays postage on all cash and C.O.D. orders. 7-Day money-back guarantee on cash or C.O.D. orders.

News About EASA

With the initial announcement of the new educational programs to be sponsored by the Electrical Apparatus Service Association, Inc. (new name for "NISA," effective April 1), applications have been coming from all parts of the country from service shop owners, managers and foremen to attend the Management Seminars and Electronic Motor Control Courses.

The Management Seminars will be held in Chicago, February 23-25; Detroit, March 16-18; Portland, Oregon, April 20-22; and New York, May 25-27. Enrollment at each seminar will be limited to 50 persons on a first-come-first-served basis. Registration fee is $75 per person.

The Electronic Motor Control Courses will be held in Philadelphia, March 6-10; Boston, March 20-24; Oklahoma City, April 17-21; Los Angeles, May 1-5; and Minneapolis, May 15-19. Enrollment will be limited to 50 persons at each Course. Registration fee is $65 per person.

Application forms for both programs are available from EASA headquarters, 7730 Carondelet Avenue, St. Louis 5, Mo.

• • • •

Sigmund Pluskota, Pluskota Electric Co., Chicago, Illinois, was elected president of the Central District Chapter at a meeting on December 13, at Petricca's Restaurant. Other officers elected were: W. C. Luebker, Hyre Electric Co., vice-president; William Kaska, Chicago Electric Co., secretary; and Leroy Nettgen, Arthur Wagner Co., treasurer. All are from Chicago firms.

The chapter also chose the following directors: Walter Hendricks, Hendricks Electric Co.; J. J. McKenna, Meade Electric Co.; James Beals, Lea Electrical Equipment Co.; Thomas Callaghan, Bowers & Clark; Elmer Jandt, C & H Electric Co.; William P. Kovacic, Condo Electric Co.; Hans D. Westphal, Westphal & Co.; and Bernard Ferrari, Excel Electric Service.

• • • •

More than half the available exhibit space at the forthcoming EASA Convention, June 11-14, at the Jack Tar Hotel, San Francisco, Calif., has been sold, according to Joseph M. Harrington, executive vice-president. Exhibitors should write Mr. Harrington, 7730 Carondelet Avenue, St. Louis 5, Mo., for details.

KALAMAZOO
METAL CUTTING BAND SAW

MODEL 8C
CUTS 8" ROUND, 16" FLAT STOCK

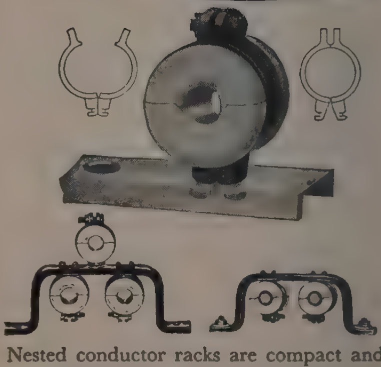
Cuts pipe and conduit faster, cleaner than other methods.

You'll do better work *easier* with the Kalamazoo Model 8C. And, it's built to give you years of dependable service.

Write for details today.

MACHINE TOOL DIVISION
Kalamazoo TANK & SILO CO.
261 Harrison Street, Kalamazoo, Mich.

FOR QUICK, EASY Cable Installation
"EFFICIENCY"
NESTED CONDUCTOR RACKS



Nested conductor racks are compact and scientifically designed to carry cables equidistant from center to center. Available in 2, 3, 4, 5 and 6 bushing racks.

Write for new catalog

EFFICIENCY
ELECTRIC & MFG. CO.
EAST PALESTINE, OHIO

The National Wiring Bureau
155 East 44th Street,
New York City 17.

Send me details on how to take advantage of Dorothy Collins' Bright Idea!

Name____

Company______________________________________

Address______________________________________

City_____________________Zone_____State__________

EC-2

Dorothy Collins' bright idea . . .

"Join me in the Housepower PROFIT PARADE for '61"

Now, TV star Dorothy Collins is selling for you! Let her lead your Profit Parade with her *bright idea*, "FULL HOUSEPOWER makes a happy home." There's a complete HOUSEPOWER *bright idea* promotion kit ready for you . . . ad mats, envelope stuffers, banners—the works—all featuring Dorothy Collins. All sell wiring improvement benefits—so you can make full profit.

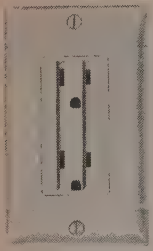
And that's not all! Edison Electric Institute sets the stage through '61 with an idea-full 2-page Medallion Home ad featuring HOUSEPOWER in – LIFE (April 21st), BETTER HOMES and GARDENS (July), SATURDAY EVENING POST (September 30th). Total circulation nearly 20,000,000—thousands in your area.

Latch onto Dorothy's invitation today and join her in the PROFIT PARADE. For complete details simply clip the above coupon and mail today.

NATIONAL WIRING BUREAU • A SPONSOR OF

HOUSEPOWER

TRADE MARK

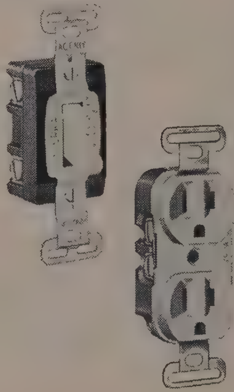


Is there actually a difference in wiring devices and wall plates? There is. Can one line be superior in beauty and performance? It can-and its name is

SIERRA

Switches, Receptacles, Wall Plates
—A complete line of wiring devices
sold only through Electrical Distributors

SIERRA ELECTRIC CORPORATION
15100 South Figueroa • Box 85 • Gardena, California



PORTABLE TRENCHER

- Low cost
- Light weight
- Portable
- More in use than any other in its class
- Completely assembled, ready to go to work
- Digs straight, curves, angles — no special setup
- Minimum of working parts — little maintenance
- Digs trenches 3" wide to 24" deep — or 4" wide to 18" deep
- Dealers in principal cities

POW-R-SPADE GUARANTEES PRODUCT & PERFORMANCE

. . . for complete details phone us collect — or mail coupon . . .

STAMPINGS, INC., Dept. E, Rock Island, Illinois
Please send details on POW-R-SPADE

Name ....

Company ....

Address ....

A number of EASA Chapters have been holding meetings recently, including—

- Connecticut Chapter, on January 5 at Waverly Inn, Cheshire, Conn.
- Florida Section, Southeastern Chapter, on February 24-26, at Tampa Terrace Hotel, Tampa, Fla.
- New England Chapter, on January 12, at Metals & Controls Division, Texas Instruments, Inc., Attleboro, Mass.
- Quaker City Chapter, on January 11, at Beck's Restaurant, Philadelphia.
- Puget Sound Chapter, on January 10, at Andy's Diner, to hear the first of three lectures on accounting by Lauren M. Walker, Professor of Accounting and Business Administration, University of Washington.

• • • •

EASA directors will serve two instead of three years, beginning in 1962 for the association's Regions No. 2 and No. 5, and in all regions effective in 1963 and 1964 as present terms expire.

The amendment to the organization's by-laws was overwhelmingly approved by the members in mail ballot. The purpose of the amendment is to give more members a chance to serve as leaders, according to Joseph M. Harrington, executive vice-president.

• • • •

Several firms have been admitted to membership this year, according to J. Arthur Turner, Jr., EASA president. They include—Salinas Armature and Motor Works, Salinas, Calif.; Naef Electric Co., Susanville, Calif.; Electric Motor Repair, Coshocton, Ohio; Rugh Electric Co., Corvallis, Ore.; Industrial Motor Servce, Racine, Wis.; Bensiker Electric Motors, Oakland, Calif.; H. A. Littlefield Corp., West Lynn, Mass.; Don's Electric Co., Merced, Calif.; Ed Kurze Electric, Inc., San Jose, Calif.; Hamilton Electric Motor Service, Seaside, Calif.; and Richards Electric Motor Co., Quincy, Ill.

In addition, a number of associate members have been admitted—Advance Carbon Co., Los Angeles, Calif.; Schenectady Varnish Co., Inc., Schenectady, N. Y.; and New Jersey Wood Finishing Co., Woodbridge, N. J.

• • • •

The 1962 EASA Convention will be held at the Conrad-Hilton Hotel in Chicago, Illinois, on June 3-7, 1962.

New Permacel cold weather plastic electrical tape
. . . remains flexible at temperatures to 50° below zero.

New Permacel Junction Box Mount epoxy adhesive
. . . the fast, easy way to attach junction boxes to any surface.

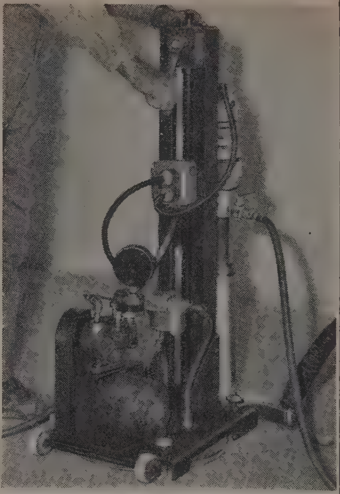
PERMACEL®

NEW BRUNSWICK, NEW JERSEY • TAPES • ELECTRICAL INSULATING MATERIALS • ADHESIVES

CUTTING POWER!

51 3-Inch Holes In One Day Through 4-Inch Concrete Floors!

A contractor drilling 5000 3-inch holes in a new office building finished *51 in one day, and once cut 21 in two hours!* Going through 3-4 inches of reinforced concrete with Longyear diamond bits took 1 to 1½ minutes, and Longyear diamond bit life was as high as 100 feet. The "305" drill was equipped with a new, compact vacuum hold-down unit, making set-up lightning-fast.



For more detailed information on application of Longyear drills, write Department 5A.

Longyear®

E. J. LONGYEAR CO.
76 S. Eighth Street, Minneapolis 2, Minnesota
Phone: FEderal 9-7631

Adv. 175A

Before you buy –

COMPARE*

BLACKHAWK ADJUSTABLE BAR HANGER

Send for your free sample – find out for yourself why it is the fastest, easiest, neatest, most economical way to hang all ceiling light fixtures.

Check Blackhawk's exclusive "clipper" – no screws to tighten – saves you time and money.

Available with or without fixture stud. Used between joists from 12" to 18"–18" to 26" Blackhawk Adjustable Bar Hangers are made of heavy gauge steel. Adjustable to required spacing. Support edges of hanger formed to act as plaster gauge. No notching necessary.

COMPARE SEND THIS COUPON TODAY.
SEND FOR YOUR FREE SAMPLE.
Blackhawk Industries, Box 708, Dubuque, Iowa
Please send me my free sample of Blackhawk Adjustable Bar Hanger
Name
Address
City State

Blackhawk Industries
Blackhawk Industries, Dubuque, Iowa
Where the new ideas come from

Statement on Bidding Procedures

The Board of Trustees of the Council of Mechanical Specialty Contracting Industries last month issued the following statement on the Council's position on contracting methods and bidding procedures.

"The Council of Mechanical Specialty Contracting Industries advocates bidding procedures which will best advance the progress of the mechanical specialty contracting industries.

"The Council believes that the separate contract method of construction provides both the owners and the construction industry the best possible construction at the fairest possible price.

"In areas where the single contract method of construction is prevalent the Council feels that methods should be devised to protect the industry from exploitation, and to this end we suggest and recommend the use of fair bidding procedures."

The Trustees explained that the statement is a clarification of the Council's position on single and separate contracting methods and fair bidding procedures which it has followed consistently since its formation as representative of the heating, electrical, plumbing, air conditioning, piping and ventilating industries several years ago.

The statement was approved at the regular meeting of the Board of Trustees of the Council in Washington, D. C. on January 12. At that meeting Robert Peterson, Kansas City, Mo., was re-elected president of the Council for 1961; Lachlan Hyatt, Spartanburg, S. C., was re-elected vice president; and G. B. Roscoe, Washington, was reappointed executive secretary.

EARLY ARRIVALS for the recent Eastern Section, IAEI convention code session are: E A. Brand, Niagara-Mohawk Power Corp., Buffalo, N. Y. (left); and G. J. Bostley, Eastern Section President for 1960, Albany, N. Y. (right).

NEC PANEL MEMBERS R. W. Osborn (left), Osborn Electric Co., St. Louis, Mo.; and Kent Stiner (right), BullDog Electric Products Co., Detroit, Mich., contributed their technical knowledge to the Eastern Section IAEI meeting at Portsmouth, N. H.

New Books

Electrical Code Diagrams, by B. Z. Segall. Third Edition; $20.00 postpaid in U. S. Peerless Publishing Co., 515 Lafayette St., New Orleans, La.

Completely re-edited, the material in this book has been revised to conform with the new format of the 1959 National Electrical Code, with many new diagrams. In loose-leaf form, the book illustrates material included in Chapters 2, 3, 4 and 5 of the code. Future code changes or additional coverage will be provided in the form of loose-leaf pages at a nominal cost, which may be inserted in the book.

Electricity and Electronics, Basic, by William B. Steinberg and Walter B. Ford. Second Edition; $4.50. American Technical Society, 848 E. 58th St., Chicago 37, Ill.

A refinement of the original text, designed to keep pace with the latest electronic developments. Features include discussions of the electron flow theory, new material on transistor fundamentals and silicon rectifiers, and additional material on new industry applications.

Electric Motor Repair Shop—Problems & Solutions, by Samuel Heller. $5.95 postpaid. Datarule Publishing Co., Box 69, Scarsdale, N. Y.

An accumulation of problems involving changes to all types of electrical equipment, as they occur in the repair shop or laboratory. Each problem is discussed with detailed step-by-step solutions. Problems involve both ac and dc equipment, including motors, generators, transformers, and auxiliary equipment.

Facts of Light!

LARGE ROOMS USE LIGHT MORE EFFICIENTLY THAN SMALL ROOMS

The greater part walls play in a room, the more loss there will be before light reaches the ultimate working level. Also, the higher fixtures are, the greater will be the percentage of wall surface available to absorb light.

FADING CAUSED BY ARTIFICIAL LIGHT DEPENDS ON THE INTENSITY OF LIGHT

There is essentially no difference between incandescent and fluorescent light in causing fading of colored materials — it is the *intensity* of light that determines the effect. Open sunlight will fade materials much more rapidly than artificial light.

A LITTLE SOAP AND WATER CAN STOP THE LOSS OF HALF YOUR LIGHT

Dust and dirt allowed to accumulate on lamps and fixtures can reduce the light they produce by nearly 50%. The owning and operating cost remains constant. By knowing how fast light is depreciating, it is easy to figure amortization and power waste and establish a cleaning program that gives you maximum lighting economy.

MANY COST-SAVING HINTS IN THE CHAMPION LIGHTING MAINTENANCE MANUAL

This manual explains the principles and advantages of good lighting practice in 48 pages. Included are sections on group replacement of lamps, cleaning programs and a guide to trouble shooting fluorescent installations. This is the latest edition of a guide that has proved to be of great practical value to lighting men everywhere. Write for a free copy.

Your Best Buy in Lamps

CHAMPION LAMP WORKS, Lynn, Massachusetts

CHAMPION INCANDESCENT-FLUORESCENT

DITCH WITCH TRENCHER

Lowest Cost Trench for

INSTALLING ELECTRICAL SYSTEMS

7 HP Model C-3 shown here

- Costs as little as 2c a foot to dig trench for all underground wiring. The C-3 Model digs 3" to 6" wide, depths to 2'. It's rugged—dependable—economical ... get a free demonstration!

OTHER SIZE DITCH WITCH, 9 TO 30 HP, DIG UP TO 16" WIDE & UP TO 6' DEEP

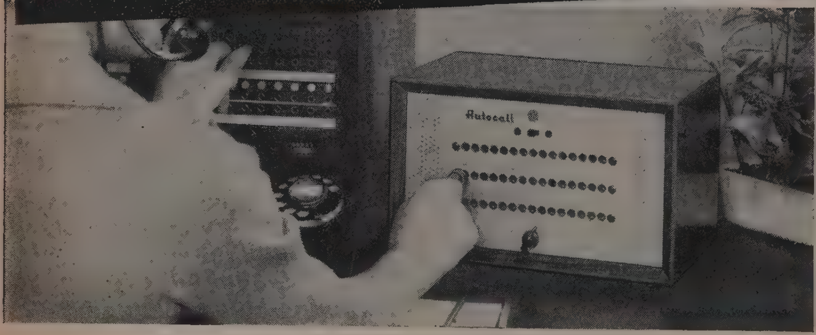
Now Available—
New Crawler Trenchers!

9 HP and
12 HP

CHARLES
Machine Works, Inc.

626 BIRCH ST. • PERRY, OKLA.
CALL COLLECT: FE 6-4404

More than ever before...AUTOCALL PAGING SYSTEMS can add to your profits!



New Autocall 800 Series Paging Systems are as modern as tomorrow . . . enhance any office decor . . . offer every coded paging convenience to improve communications.

Here's a brand new opportunity for replacement business as well as new installations, for many companies in your area have outmoded systems . . . want both the new features and the modern new Central Sending Stations.

You can develop this *plus* business with minimum sales time and expense. Autocall provides complete literature . . . everything you need to promote, quote and install this much needed equipment . . . and there is a nearby Autocall representative ready to give you the sales assistance you need.

A letter or a phone call will get you the facts.

Autocall®
PAGING SYSTEMS

THE AUTOCALL COMPANY • SHELBY 9, OHIO • SALES OFFICES IN PRINCIPAL CITIES

NEW YORKERS attending the Eastern Section IAEI meeting at Portsmouth, N. H. included (L-R): T. H. Mackie, recently retired, Westchester chief electrical inspector, NYBFU, Pleasantville, N. Y.; H. V. Metz, Cucinell Electric Co., Yonkers, N. Y.; and A. J. Reed, Long Island chief electrical inspector, NYBFU, Levittown, N. Y.

Fluorescent Lighting Manual, by Charles L. Amick. Third Edition; 416 pages; $12.50. McGraw-Hill Book Co., 330 W. 42nd St., New York 36, N. Y.

A practical guide to design, installation and repair of fluorescent lighting systems, up-dated and revised to bring it abreast of modern practice. Material includes a simple treatment of the principles and procedures for calculating illuminating requirements, the design of luminaires and auxiliary equipment, and practical methods to use in maintaining and repairing all parts of any fluorescent lighting system.

Ultrasonics and Its Industrial Applications, by O. I. Babikov; 230 pages; $9.75. Consultants Bureau Enterprises, Inc., 227 W. 17th St., New York 11, N. Y.

Translated from Russian, this volume covers recent Soviet advances. The author discusses ultrasonic control methods, drilling techniques, flow detection and various other technological processes, in addition to the fundamental physical principles involved.

Bibliography and Abstracts on Electrical Contacts, 1959 Supplement. 64 pages; $3.50. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

A carefully selected list of articles and abstracts on a wide variety of subjects relating to the operation of electrical contacts. Material is presented in chronological order. A subject index groups bibliography according to separate problems; an author index permits following the work of an individual author.

GAS BUGGY lounge in San Francisco's new Jack Tar Hotel is uniquely advertised by antique car which, in this instance, is being driven by Lloyd Dehrer, Chief E. E., Buonaccorsi & Murray, consulting engineers, and James Dellos, Supervisor, Emil J. Weber Electric Co. This "team" was responsible for electrical installation in this impressive new hotel-office building, where the Gas Buggy lounge attracts particular interest due to a unique mosaic-metallic mural incorporating incandescent and ultra-violet fluorescent lamps, motorized cycling dimmers plus miniature "headlight" effects.

Digest of Military Electronics; 210 pages; $3.95 postpaid. RCA Service Co., Government Services (Bldg. 210), Camden 8, N. J.

A new reference book explaining the uses of electronics in modern military equipment and systems. Written in simple language, the book explains terminology and covers the purpose and function of such systems as RADAR, LORAN, and SONAR.

Engineering Professionalism in Industry; 104 pages; $4.00. National Society of Professional Engineers, 2029 K St., N. W., Washington 6, D. C.

Results of a survey designed to find out what engineers and engineering managers mean by professionalism, and how they think it can best be advanced. Discussed are such topics as personnel attitudes, salary progression, unionism, advanced education, participation in technical societies, and many other considerations applying to the engineer.

Facts About Home Wiring. 35 mm slides; $60 per set. National Wiring Bureau, 155 E. 44th St., New York 17, N. Y.

A set of 36 35-mm color slides depicting fundamental facts about full Housepower—what it is, what it does. Included are two copies of a script, forming a complete lecture designed to do a basic educational job on the elements of an adequate home wiring system.

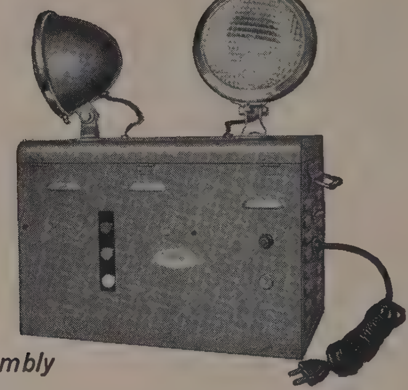
ROYAL Portable Cords

are dependable, easy working, made right to be right on every job, time after time after time. Royal is the BIG line, too . . . rubber, neoprene and thermo-plastic, as well as lamp cords, fixture wires, machine tool wires, thermo cables, bell wires, coaxial cables, and more. All packaged for fast, easy identification. So when you buy wire and cable, specify ROYAL, the line that's preferred by electrical men everywhere. See your wholesaler, or write for catalog, giving wholesaler's name.

ROYAL ELECTRIC
...an associate of ITT

ROYAL ELECTRIC CORPORATION
PAWTUCKET • RHODE ISLAND
In Canada: Royal Electric Company (Quebec) Ltd.
Pointe — Claire, Quebec

MAKE SAFE BUILDINGS *SAFER* with
Beam-O-Matic
AUTOMATIC EMERGENCY LIGHTS



for commercial buildings, retail stores, institutions factories . . . and other places of public assembly

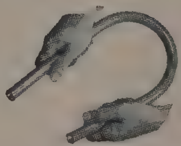
No building is completely safe without protection from the hazards of sudden blackouts. Leading industries have adopted BIG BEAM for their emergency lighting needs. When regular lights fail, BIG BEAM goes on instantly and automatically. Provides hours of bright, safe illumination, until power from circuit is restored. BEAM-O-MATIC recharges itself automatically.

BEAM-O-MATIC shown above is one of a variety of BIG BEAM models available. Whichever BIG BEAM you select, you are providing the utmost in dependability.

For complete information, write today to 9475

U-C-LITE MFG. CO. 1035 W. Hubbard St., Chicago 22, Ill.
Canada: Bernard Marks & Co., Ltd., 32 Alcorn Avenue, Toronto 7, Ontario

INSTALLATION AS FAST
AS WITH REGULAR
FLEXIBLE CONDUIT



PROTECTION AS SURE
AS RIGID
CONDUIT

LIQUATITE®

EXTRUDED POLYVINYL JACKET MOLDED TO GALVANIZED FLEXIBLE CONDUIT

Complete protection against any and all contamination–impervious to water, oils, chemicals, corrosive atmospheres. Installed in minutes. No more "downtime" due to wiring shorts or burnouts, no more periodic wiring replacements.

Type LT JIC Approved
Type LA
Underwriters' Approved
•
Write for free sample, costs and name of Distributor nearest you.

LIQUATITE ®
ELECTRI-FLEX COMPANY
P. O. BOX 128-C • ROSELLE, ILLINOIS

DATES AHEAD

National Rural Electric Cooperative Association — 19th annual meeting, Dallas, Texas, February 13-16.

15th International Heating & Air-Conditioning Exposition — International Amphitheatre, Chicago, Ill., February, 13-16.

3rd Biennial Electrical Trade Conference and Exposition—Sheraton-Park Hotel, Washington, D. C., February 14-16.

Upper Midwest Electrical Industry Convention — Leamington Hotel, Minneapolis, Minn., February 19-22.

National Electric Sign Association—Convention, Benjamin Franklin Hotel, Philadelphia, Pa., Feb. 19-22.

Electrical Show—1961 Denver Electrical and Electronics Exhibit, Denver Hilton Hotel, Denver, Colo., February 21-22.

17th Annual National Wiring Sales Conference—Sherman Hotel, Chicago, Ill., February 23-24.

3rd National Lighting Exposition and World Lighting Forum—Coliseum, New York City, N. Y., March 5-8.

Edison Electric Institute — Annual sales conference, Edgewater Beach Hotel, Chicago, Ill., March 20-22.

American Power Conference—Sherman Hotel, Chicago, Ill., March 21-23.

Nebraska Iowa Electrical Council—4th Biennial Nebraska-Iowa Electrical Trade Show, Peony Park Auditorium, Omaha, Neb., March 21-23.

International Association of Electrical Inspectors—Chapter Meetings—**Mississippi**, Heidelberg Hotel, Jackson, Miss., March 27-28; **Georgia**, Forrest Hotel, Rome, Ga., April 10-11; **Ellis Cannady**, Carolina Hotel, Raleigh, N. C., April 12-13; **Alabama**, Tutwiler Hotel, Birmingham, Ala., April 17-18; **South Carolina**, Cabana Inn, Spartanburg, S. C., April 20-21; **Five Chapter Joint Meeting**, Windsor Hotel, Abilene, Texas, April 28-29; **Florida**, Casa Marina Hotel, Key West, Fla., May 5-6; **Virginia**, Hotel Roanoke, Roanoke, Va., June 12-13; **Northwestern Section**, Owyhee Hotel, Boise, Idaho, Sept. 11-13; **Southwestern section**, Hotel Del Coronado, Coronado, Calif., September 18-21; **Western Section**, Biltmore Hotel, Oklahoma City, Okla., September 25-27; **Canadian Section**, Toronto, Ont., September 29-30; **Eastern Section**, Warwick Hotel, Philadelphia, Pa., October 9-11; **Southern Section**, Grove Park Inn, Asheville, N. C., October 16-18.

Electrical Supply Trade Show—Sponsored by the Electrical Association of Kansas City, Exhibition Hall, Municipal Auditorium, Kansas City, Mo., March 28-30.

Electrical Trade Show—Sponsored by St. Louis Electrical Board of Trade, April 4-6.

Northern California Electrical Industry Show—Sponsored by the Electrical Maintenance Engineers' Association of Northern Calif., Brooks Hall, San Francisco, Calif., April 5-9.

1961 Electrical Home Show—Community War Memorial, Rochester, N. Y., April 8-15.

Illuminating Engineering Society — Regional Conferences: **East Central**, Benjamin Franklin Hotel, Philadelphia, Pa., April 10-11; **Southwestern**, Skirvin Hotel, Oklahoma City, Okla., April 17-18; **Southeastern/South Central**, Biltmore Hotel, Atlanta, Ga., April 20-21; **Inter-Mountain**, Salt Lake City, Utah, May 1-2; **South Pacific Coast**, Sacramento Inn, Sacramento, Calif., May 4-5; **Pacific Northwest**, Harrison Hot Springs, Harrison, B. C., May 8-9; **Canadian**, Queen Elizabeth Hotel, Montreal, Que., May 15-16; **Northeastern**, Berkeley-Carteret Hotel, Asbury Park, N. J., June 8-9; **Great Lakes**, Sheraton-Gibson Hotel, Cincinnati, Ohio, June 19-20.

Missouri Valley Electrical Association — Annual engineering conference, Hotel President and Municipal Auditorium, Kansas City, Mo., April 12-14.

2nd Annual Alabama Electrical & Electronics Exposition—Birmingham Municipal Auditorium, Birmingham, Ala., April 17-19.

15th New England Electrical Show—Sponsored by Electrical Manufacturers Representatives Club, Commonwealth Armory, Boston, Mass., April 18-20.

National Association of Electrical Distributors—53rd annual convention, Detroit, Mich., April 29-May 3.

National Fire Protection Association—Annual convention, Hotel Statler, Detroit, Mich., May 15-19.

Edison Electric Institute—Annual convention, New York, N. Y., June 5-7.

Electrical Apparatus Service Association, Inc.—28th annual convention, Jack Tar Hotel, San Francisco, Calif., June 11-14.

New York State Association of Electrical Contractors & Dealers—62nd annual convention, Whiteface Inn, Lake Placid, N. Y., July 2-7.

Western Plant Maintenance Show—Pan American Auditorium, Los Angeles, Calif., July 18-20.

National Assn. of Lighting Maintenance Contractors—National conference, Las Vegas, Nev., August 21-23.

Western Electronic Show and Convention—Cow Palace, San Francisco, Calif., August 22-25.

American Home Lighting Fixture Month—Sponsored by the American Home Lighting Institute, Chicago, Ill., September 1-30.

Illuminating Engineering Society—National Technical Conference, Chase Park Plaza Hotel, St. Louis, Mo., September 24-29.

International Association of Electrical Leagues—25th Annual Conference, President Hotel, Atlantic City, N. J., October 4-6.

Canadian Electrical Manufacturing Association—Annual meeting, Sheraton Brock Hotel, Niagara Falls, Ontario, October 4-6.

17th Annual National Electronics Conference — International Amphitheatre, Chicago, Ill., October 9-11.

National Electrical Contractors Association—Annual convention, Washington, D. C., October 9-14.

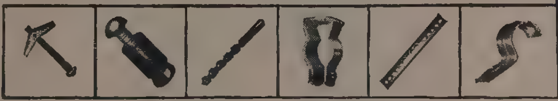
National Electrical Manufacturers Assn.—Annual meeting, Traymore Hotel, Atlantic City, N. J., November 13-17.

The FREE Catalog that tells all!

NEW NET PRICE SHEET CATALOG ON PAINE'S HANGING AND FASTENING DEVICES FOR THE BUILDING TRADES

This handy guide and ready reference tells you the current net price you should pay for any Paine item from your local Jobber, Distributor or Wholesaler. Along with net prices, this 20 page catalog gives you valuable information on sizes, specifications, part numbers, installation tips, and other facts about Paine's complete line of hanging and fastening devices. It's indexed, easy to read and illustrated. A working tool for any cost conscious contractor. Send for your FREE helpful catalog today!

the best craftsmen always take PAINE'S



I would appreciate receiving a copy of your new net price sheet catalog.
(PLEASE PRINT THE FOLLOWING INFORMATION)

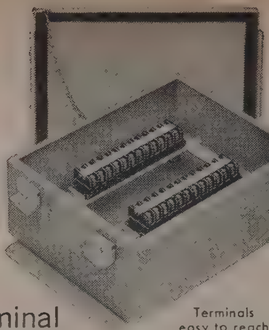
Name:____________________
Company:____________________
Address:____________________
City:____________________ Zone_____ State________
Include______additional copies for distribution to others in the same company.

THE PAINE COMPANY
501 Westgate Road • Addison, Illinois

NEW

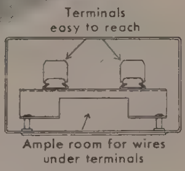
J.I.C. Terminal Box

OIL-TIGHT DUST-TIGHT



Complete with Terminal Blocks (or brackets only)

Designed for faster, easier wiring



Famous trade-approved Hoffman JIC box is now available with new time-saving mounting brackets for terminal blocks that leave plenty of space for wires . . . and make wiring easy wherever conduit connections are located.

Equipped with medium duty, sectionalized terminal blocks; or with brackets only—you mount your own terminals. Blocks mount on steel straps. Additional straps may be added at a later date if more circuits are needed.

Boxes are completely oil and dust tight with JIC screw clamps to close gasketed covers. Standard box sizes range from 8″x6″x3½″ to 16″x14″x6″ offering 16 to 64 terminals. Similar terminal system also available in large NEMA-12 enclosures.

Hoffman ENGINEERING CORPORATION
Dept. ECM161, Anoka, Minnesota

SHERMAN TERMINAL LUGS AND CRIMPING TOOLS

SPEED INSTALLATION – REDUCE COSTS!

MONEY SAVER

SAVE UP TO 15% WITH SHERMAN

Write for FREE Sample

SHERMAN UNI-CRIMP LUG

SHERMAN "ST" LUG

SHERMAN HAND CRIMPING TOOLS

Portable or bench mounted for fast, easy installation of money-saving Sherman terminal lugs.

H. B. SHERMAN MANUFACTURING CO., BATTLE CREEK, MICHIGAN

Among the Manufacturers

Headquarters Announcements

The Toledo Pipe Threading Machine Co. has been acquired by **Curtis Manufacturing Co.**, Cleveland, Ohio, as a subsidiary. Norman J. Kirk will continue as president and general manager. New appointments are Harold C. Shott, board chairman; Arthur L. Nagel, vice president; Earl R. Youngs, vice president and sales manager.

Minneapolis-Honeywell Regulator Co., has changed the name of its Marion Instrument Div., Manchester, N. H., to Precision Meter Div.

The Electric Storage Battery Co., Philadelphia, Pa.—C. J. Moore, vice president of marketing of new Exide Industrial Marketing Div.

Beaver Pipe Tools, Inc., Warren, Ohio—William W. Mastern, regional sales manager.

"Genie-Air" Products, Los Angeles, Calif.—W. C. Walter, national marketing manager.

Hitemp Wires Co., Westbury, N. Y.—Theodore R. Sheron, sales manager.

J. I. Case Co., Racine, Wis.—W. J. Grede, chairman of the board.

H. K. Porter Co., Inc., Pittsburgh, Pa.—Walter A. Curtis, general manager, Peerless Electric Div., Warren, Ohio; Shannon C. Powers, general manager, National Electric Div., Ambridge, Pa.

General Electric Co., Schenectady, N. Y.—Stanley R. Sulis, manager of instrument and product planning, and Frederick W. Newman, manager of product service, Instrument Dept., West Lynn, Mass.; Everett N. DeVault, manager of manufacturing engineering, Outdoor Lighting Dept.

Fairbanks, Morse & Co., Chicago Ill.—Thomas G. Lanphier, Jr., president.

Porter-Cable Machine Co., Syracuse, N. Y.—Francis H. Gerlach, vice president of engineering.

MicroSemiconductor Corp., Culver City, Calif.—Steve Manning, vice president of marketing.

Air Reduction Sales Co., Union, N. J.—J. H. Berryman, manager, and Robert A. Stone, sales manager, Special Products Dept.

Revere Electric Mfg. Co., Niles, Ill.—Leland M. Wallace, manager of street lighting sales.

'ROUND-THE-CLOCK operation of a Nevada casino and supper-club is a tough assignment but one which is handled capably at Harrah's new South Shore Room, Lake Tahoe, by Austin Raymer, engineer, and Lloyd Brewer, his assistant.

International Register Co., Chicago, Ill.—Douglas M. Kinney, board of directors; Fred A. Linn, director of engineering.

Edwards Co., Inc., Norwalk, Conn.—Carl D. Cordua, manager of general engineering; Irving Mande, manager of research and development; John E. Kreiner, general manager of engineering; A. B. Thomas, product manager of distributor products.

Oak Manufacturing Co., Crystal Lake, Ill.—Stewart Pfannstiehl, vice president-marketing.

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—S. M. Austin, manager of water conditioning products section, Thermal Power Dept.

The Electric Specialty Co., Stamford, Conn.—Herbert W. Thode, general sales manager.

Buchanan Electrical Products Corp., Hillside, N. J.—George Ustin, vice president and general manager; James O. Johnson, director of sales promotion and advertising; Albert Mittleman, manufacturing manager; Charles F. Walker, sales service manager.

Regional Appointments

NEW ENGLAND

I-T-E Circuit Breaker Co.: Harry G. Johnson, North-Atlantic area manager, Boston, Mass.

MIDDLE ATLANTIC

I-T-E Circuit Breaker Co.: Louis H. Hopper, Mid-Atlantic area manager, New York City.

J. B. Nottingham & Co., Inc.: Richard H. Snyder, manager of Middle Atlantic region, headquarters in Glenside, Pa.

NEW glamor NEW comfort

with Electromode's new infrared heater

This new Quartzone® Electric Heater makes every bathroom modern. It's the logical luxury touch in new homes, a "must" in remodeling.

What makes it different from many other heaters is the fact that it warms with infrared rays. As a result it warms people, not just the air. It puts an end to annoying drafts and overheating.

You'll like the ease of installation; it goes in as easily as an ordinary fluorescent lighting fixture. Mount it on a standard outlet box either in the ceiling or on any wall. It tilts 20° to direct warmth where it's most wanted.

And forget about costly call-backs with this rugged unit. That sturdy Quartzone tube stands up to sudden temperature changes and won't crack even if water splashes on it. There's also a chrome guard to protect the tube and the highly polished reflector plate.

The new Electromode Quartzone Bathroom Heater comes in two models, 120 and 240 volts. Larger units are available for outdoor applications.

For all the facts, contact your ELECTROMODE representative, or write to: Electromode, Dept. EC-21, Division of Commercial Controls Corporation, 570 Culver Rd., Rochester 3, New York

®Electromode

G&W POTHEAD UNIT PACKAGING speeds installation; cuts inventory and costs!

Every component, device, and accessory required for installing a G&W standard Pothead is quickly gathered from "off-the-shelf", carefully and securely packaged, and shipped *complete* in a single carton. Once put into inventory, the needed number of potheads may be drawn from stock, unpacked right at job-site, and put into service in short order. Not only are substantial inventory savings affected, but installation costs materially are reduced.

Unit Packaging is another benefit gained from G&W's constant development of cable accessories and switchgear; another reason why it profits you to recommend, specify, and install G&W equipment. Ask a G&W representative, or write for information about G&W potheads and terminations.

G&W standard capnut Pothead ready for shipment as a typical Unit Package.

G&W ELECTRIC SPECIALTY COMPANY
3514 WEST 127TH STREET • BLUE ISLAND, ILLINOIS
CANADIAN MFR. • POWERLITE DEVICES, LTD.
TORONTO, MONTREAL & VANCOUVER
superior quality standards – inspired specialized design
G61-1

USING THE CODE to prove his points, Paul W. Wittenberg, chief electrical inspector, City of St. Louis, takes active part in code forum at recent convention of Western Section, IAEI in Kansas City.

Air Reduction Sales Co.: L. W. Kunkler, district manager, Buffalo office.

SOUTH ATLANTIC

I-T-E Circuit Breaker Co.: George R. Hoffman, Southern area manager, Atlanta, Ga.

EAST CENTRAL

I-T-E Circuit Breaker Co.: Robert C. Engemoen, Midwest area manager, Chicago, Ill.

Flexible Tubing Corp.: H. John Asma, regional sales manager, Technical Products, headquarters in Hillside, Ill.

Stanley Electric Tools: Walter J. Finkler, sales representative in western Michigan, northwest Indiana and northeast Illinois.

Oak Mfg. Co.: Morris, Cunningham & Associates, Indianapolis, Ind., manufacturing representative in Indiana and Kentucky.

WEST CENTRAL

Stanley Electric Tools: Calvin H. Quick, sales representative in north Texas.

WEST

I-T-E Circuit Breaker Co.: Robert G. Petersen, Pacific area manager, San Francisco, Calif.

H. J. Theiler Corp.: Bergman-Marshall Co., Inc., San Francisco, Calif., representative in northern California including Reno, Nev.

The Potter Co.: George W. Ledbetter, manufacturers' representative in California, Oregon and Washington, from offices in Los Angeles, San Diego, and San Francisco.

Chrysler Corp.: Philip B. Lockwood, west coast branch manager, Airtemp Div.

Millions of Steel JIFFY CLIPS Serving the Electrical Industry

Specify MINERALLAC HANGERS, CLIPS, STRAPS, BUSHINGS

Expert design, choice materials and controlled manufacture have built "top-service and longest life" into Minerallac Electrical Specialties. That's why the electrical industry "prefers Minerallac"... In steel and Everdur for hanging pipe, conduit, BX cable, etc.

Send for new literature and prices.

MINERALLAC ELECTRIC COMPANY
25 North Peoria Street—Chicago 7, Illinois

MINERALLAC

HELWIG CARBON BRUSHES

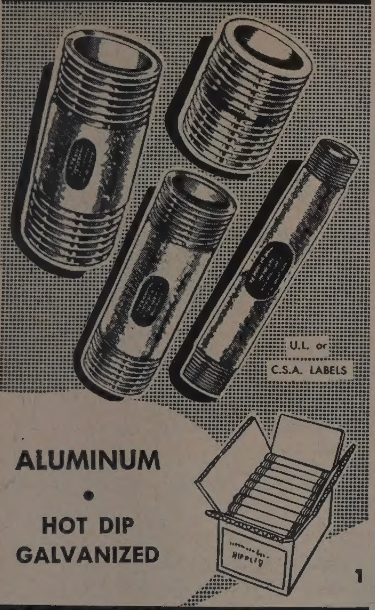
Under most extreme conditions, high capacity Red Top brushes maintain even current distribution. Commutator maintenance is reduced to minimum. Equipment continues to function smoothly, and efficiently.

FREE SURVEY of your equipment by our field trained engineers. Write today. There's no obligation.

HELWIG SPEER

HELWIG CARBON PRODUCTS, INC.
2544 North 30th Street, Milwaukee 10, Wisconsin

RIGID Conduit
PIPE NIPPLES



ALUMINUM
•
HOT DIP
GALVANIZED

CONDUIT NIPPLE MFG. CO.
1455 SPRING GARDEN AVE. PITTSBURGH 12, PA.

INDOOR and OUTDOOR
PHONES
that need no current

Your voice
supplies the power
needed to operate
these Sound
Powered Telephone
handsets over a
distance of many
miles. Never fail
in an emergency.
For temporary
or permanent installation.

Write for catalog
HOSE-McCANN
TELEPHONE CO., INC.
25th St. & 3rd Ave., Brooklyn 32. N.Y.

ESTIMATING FORUM—IX

[FROM PAGE 78]

vant items taken from Fig. 1, we get the following estimated savings on the total installation:

Lighting Branch Wiring (Conduit and Boxes) 1% of 425	— 4.25 hrs.
Feeders (Conduit and Pull Boxes)—9.6% of 150	— 14.40 hrs.
Total	— 18.65 hrs.

This 18.65 hours represents a saving of approximately 1.4% of the total project installation time of 1,389 hours (see Fig. 1).

The same installation without bus duct would have had a total of 1,217 hours and the estimated saving would have been approximately 1.6%. Probably, this is a highly over-simplified approach. Chances are that, if bus duct were eliminated, the project would have more feeders and subfeeders run in conduit. This would be reflected in the conduit totals in Fig. 1. The percentage savings would then be applied to the higher figures.

From the above discussion we have established labor savings of 1.4% to 1.6% of the total hours on the project studied, depending upon design details. While this is well within the estimated 1% to 2% savings in our original answer, there is a general feeling that these values are quite conservative. Under favorable conditions and with a larger percentage of heavy conduit involved, one could expect to approach the 2% figure.

There is one thing to remember. Regardless of the values used, the method of estimating savings effected by power tools remains the same.

ST. LOUIS DIRECTOR of Public Safety Joseph P. Sestric tells electrical inspectors at Western Section, IAEI convention in Kansas City, that education and enforcement are necessary to make any law meaningful.

KATOLIGHT PORTABLE POWER PLANTS give your crews "plug-in" electricity anywhere, whenever it is wanted. Here is handy, dependable electric power to operate all types of power tools or to provide steady, bright flood lighting.

Standard sizes and models for every portable, standby or continuous use from 350 watts to 125 KW.

Special Units up to 750 KVA to meet specific requirements.

With instant, dependable Katolight electric power on the job, work speeds up . . . costs go down!

Write Today for Details!

KATOLIGHT CORPORATION
Box 891-53 MANKATO, MINNESOTA

SEARCHLIGHT SECTION

WANTED
ENGINEERING EXECUTIVE

Responsible administrative engineering position available with well established, widely known electrical service and industrial contracting business in New York. Will work with a compact, congenial group and share in their accomplishments and progress.

Requirements: E. E. degree, with previous experience in electrical plant maintenance supervision. Specific experience in light and power wiring installations desirable but not required. Age 30 to 40.

Remuneration: salary plus bonus.

Interviews will be granted by appointment only. Give in first letter detailed past experience and salary requirements.

P5996 Electrical Construction & Maintenance
Class. Adv. Div., P.O. Box 12, N. Y. 36, N. Y.

We are interested to buy or associate with Company

which has whole or part of used manufacturing equipment for sale, to make electrical products like fluorescent ballasts, starters, switches, relays capacitors, electrical appliances, etc.

Have plant space available.

Very good opportunities for industry, due to custom restrictions on importation of products.

Write directly giving full details of machines and products to make, To:

Apartado Aereo 6852
BOGOTA Colombia S. A.

SAVE! SAVE! SAVE!
Buy accurate, dependable, rebuilt
WATTHOUR METERS
for any electric service, and buy for less ! !
Also repair and recalibration service.
HIALEAH METER CO.
Dept. ECM
829 E. 25th Street Hialeah, Florida

Advertising In This Issue

Adalet Mfg. Co., The 146
Adam Electric Co., Frank 6
• Advance Transformer Co. 16
Allen-Bradley Co. 147, 148
Allis-Chalmers Mfg. Co. 29
• All-Steel Equipment, Inc—Raco Div. 27
• American Louver Co. 41
Appleton Electric Co. 2
• Arrow Conduit & Fittings Corp. 158
Arrow-Hart & Hegeman Electric Co., The 134, 135
Arvin Industries, Inc. 108
Auth Electric Co., The 43
Autocall Co., The 176

Bethlehem Steel Co. 111
• Biddle Co., James G. 164
Black & Decker Mfg. Co., The 98, 99
• Blackhawk Industries 174
• Briegel Method Tool Co. 169
BullDog Electric Products Division, I-T-E Circuit Breaker Co. 62
Burndy Corp. 117

Certified Ballast Mfgrs. 131
• Champion DeArment Tool Co. 133
Champion Lamp Works 175
Charles Machine Works, Inc. 176
Circle Wire & Cable A Subsidiary of Cerro de Pasco Corp. 101
Conduit Nipple Mfg. Co. 183
Cope Div., T. J., Rome Cable Corp. 30
Corrosion Reaction Consultants 36
Coyne Electrical School 170
• Crouse-Hinds Co. .... Fourth Cover
• Cutler-Hammer, Inc. 44, 45

• Day-Brite Lighting Inc. 120, 121
Dodge Corp., F. W. 155
duPont de Nemours & Co., Inc., E. I. 52
Dow Corning Corp. 31

Eagle Electric Mfg. Co., Inc. 110
• Efficiency Electric & Mfg. Co. 170
Electrical Tubular Products 154
Electri-Flex Co. 178
Electromode Div. of Commercial Controls Corp. 181
Erico Products, Inc. 137
Executone, Inc. 159
Exide Industrial Marketing Division, The Electric Storge Battery Co. 53

Fasco Industries, Inc. 119
Federal Pacific Electric Co. 126, 127
• Fullman Mfg. Co. 166
• Furnas Electric Co. 160

• G & W Electric Specialty Co. 182
Gamewell Co., The 37
• General Electric Co.
  Apparatus Sales Div. 14
  Construction Materials Div. 157
  Wiring Device Dept. 38, 39
• Graybar Electric Co., Inc. 4, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26
Greenlee Tool Co. 54, 55
Guth Co., The Edwin F. .... Second Cover

Heinemann Electric Co. 130
• Helwig Carbon Products Inc. 182
• Henderson-Hazel Corp. 168
Hitachi, Ltd. 128
• Hoffman Engineering Corp. 180
Holophane Co., Inc. 123
• Hose-McCann Telephone Co., Inc. 183
• Hubbell Inc., Harvey 132

• Ideal Industries, Inc. 35, 144
I-T-E Circuit Breaker Co. 103, 112
I-T-E Circuit Breaker Co., Walker Div. 47

Jet Line Products, Inc. 100
• Johns-Manville 40
Johns-Manville Dutch Brand Division 48, 49

Kalamazoo Tank & Silo Co. 170
Katolight Corp. 183
• Killark Electric Mfg. Co. 142, 143
Kleigl Bros., Inc. 136
• Klein & Sons, Mathias 116

Line Material Industries 33
Longyear Co., E. J. 174

McGill Mfg. Co., Inc. 46
McGraw-Hill Book Co. 168
McPhilben Lighting Co. 149
Miller Co., The 129
• Minerallac Electric Co. 182
Minneapolis-Honeywell Regulator Co. 104, 105

• National Price Service 168
National Supply Division, Armco Steel Corp. 165
National Tube Div. of U. S. Steel 34
National Wiring Bureau 171

Okonite Co., The 109

• Paine Co., The 179
Pass & Seymour, Inc. 153
Permacel 173
• PLM Products Inc. 122
Plymouth Rubber Co., Inc. 15
Pringle Electrical Mfg. Co. 156
Pyramid Instrument Corp. 95, 96

Rawlplug Co., Inc., The 102
Republic Steel Corp. 150, 151
Revere Electric Mfg. Co. 162
Ridge Tool Co., The 138, 139
• Rome Cable Div. of Alcoa 12, 13
Royal Electric Corp. 177

Sherman Mfg. Co., H. B. 180
• Sierra Electric Corp. 172
• Simplex Wire & Cable Co. 125
Skil Corp. 167
Slater Electric & Mfg. Co., Inc. 161
• Sorgel Electric Co. 10, 11
Square D Co. .... Third Cover, 1, 8, 145
Stampings Inc. 172
Standard Transformer Co. 118
• Steelduct Co., The 42
Steel & Tubes Div. 150, 151
Sylvania Electric Products, Inc. 50, 51, 60

• Thomas & Betts Co., The 166
• Triangle Conduit & Cable Co., Inc. 140

• U. S. Steel 34
• U-C Lite Mfg. Co. 178
United States Rubber Co. 28

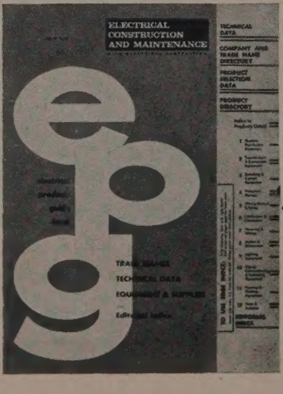
• Wagner Electric Corp. 106, 124
• Weaver Co., J. A. 32
• Westinghouse Electric Corp. Pittsburgh 56, 57, 58, 59

■

CLASSIFIED ADVERTISING

F. J. Eberle, Business Mgr.

EMPLOYMENT OPPORTUNITIES 183
BUSINESS OPPORTUNITIES 183
EQUIPMENT (Used or Surplus New) For Sale 183

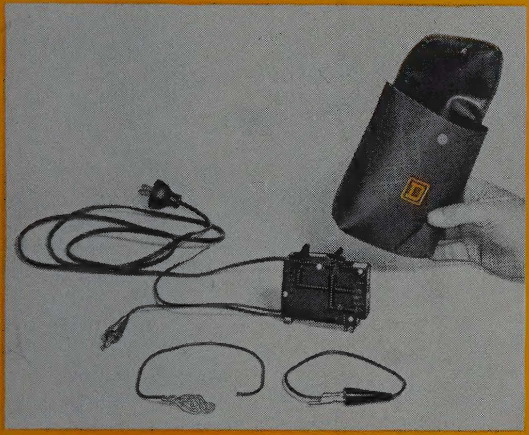


• These manufacturers advertised their products in the ELECTRICAL PRODUCTS GUIDE ISSUE

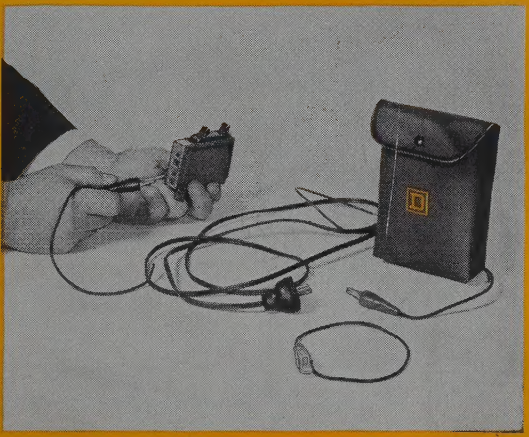
For more complete information, and application data on their lines, refer to the index of Advertisers in the ELECTRICAL PRODUCTS GUIDE . . . the 13th issue of ELECTRICAL CONSTRUCTION AND MAINTENANCE.

Want proof that QO is THE FINEST BREAKER EVER BUILT?

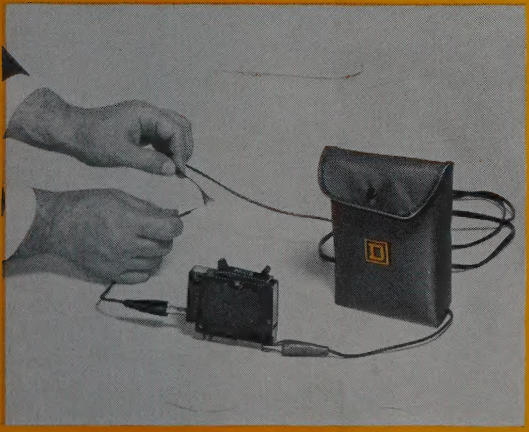
—It's in the Bag...



ABOVE • **No bag of tricks—a QO breaker, a lamp cord, a receptacle, a few spring clips and a paper clip are all it takes to prove QO's case by actual performance.**



ABOVE • **Push-in terminals, a Square D exclusive, provide fast, positive connections. A standard time-saving feature on all QO TANDEM breakers. Notice how the QO TANDEM breaker shown above combines 2 full-size breakers in 1 space-saving unit.**



AT LEFT • **The frayed cord test shows how QO breakers give positive protection against "*flash*" shorts. Conventional overcurrent protectors provide overload and short circuit protection for branch wiring, but don't open fast enough to protect smaller extensions from such shorts.**

●

Make a demonstration date with your Square D Field Engineer... or let us send you the complete story. Address Square D Company, Mercer Road, Lexington, Kentucky.

SQUARE D COMPANY

wherever electricity is distributed and controlled

CROUSE/HINDS Dust-Tight* Lighting

IN ACTION!

Caked and blanketed with layer on layer of dust, the DLA Dust-Ignition-Proof Lighting Fixture in our picture continues to function perfectly . . . at safe operating temperature . . . month in, month out. That's because it's sealed tight and stays cool. Dust can't get in and won't catch fire . . . no matter how thick you pile it!

You can get Crouse-Hinds dust-ignition-protection for any type of lighting . . . incandescent, fluorescent or mercury vapor . . . bench, area or flood . . . stationary or portable! But that only skims the surface of your dust-danger problems.

*Dust-Ignition-Proof

How about circuit-breaking plugs and receptacles interlocked with switches? Or push-button stations with tumbler or mercury switches? . . . control stations, pilot lights and panel boards? . . . motor starters, circuit breakers and combinations? Even telephones, instruments and signals? Crouse-Hinds has dust-ignition-proof protection for them all. For hundreds of others, too

Get whatever you need from a single source. Just ask your Crouse-Hinds Distributor.

CROUSE/HINDS
SYRACUSE NEW YORK

OFFICES: Atlanta Baton Rouge Birmingham Boston Buffalo Charlotte Chicago Cincinnati Cleveland Corpus Christi Dallas Denver Detroit Houston Indianapolis Kansas City Los Angeles Milwaukee New Orleans New York Omaha Philadelphia Pittsburgh Portland, Ore. St. Louis St. Paul Salt Lake City San Francisco Seattle Tulsa Washington

RESIDENT REPRESENTATIVES: Albany Baltimore Reading, Pa. Richmond, Va.

Crouse-Hinds of Canada, Ltd., Toronto, Ont. Crouse-Hinds-Domex, S. A. de C. V. Mexico City, D. F. Peterco, Sao Paulo, Brazil